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YORKSHIRE PHILOSOPHICAL SOCIETY.



# ANNUAL REPORT

FOR

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ANNUAL REPORT  
OF THE COUNCIL  
OF THE  
YORKSHIRE  
PHILOSOPHICAL SOCIETY

FOR  
MCMXX.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 14th, 1921.



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YORK:  
COULTAS & VOLANS LTD., PRINTERS, LITTLE STONEGATE.  
1921.

TRUSTEES  
OF  
THE YORKSHIRE MUSEUM,  
APPOINTED BY ROYAL GRANT,  
GEORGE A. AUDEN, M.D.  
LORD DERAMORE.  
CHAS. E. ELMHIRST.  
SIR GEORGE GIBB, LL.B.  
EDWIN GRAY, LL.M.

PATRONS  
OF THE  
**Yorkshire Philosophical Society.**

HIS MAJESTY THE KING.

HER MAJESTY THE QUEEN.

QUEEN ALEXANDRA.

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WILLIAM HERBERT ST. QUINTIN, J.P., D.L.

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ARCHÆOLOGY - - - -	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 4em; vertical-align: middle; margin-right: 5px;">{</div> <div> W. HARVEY BROOK.  Rev. Canon J. SOLLOWAY, D.D.  G. BENSON, A.R.I.B.A.  W. A. EVELYN, M.A., M.D., Cantab. </div> </div>
GEOLOGY - - - - -	Rev. W. JOHNSON, B.A., B.Sc.
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ENTOMOLOGY - - - - -	S. WALKER.
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Rev. W. JOHNSON, B.A., B.Sc.  
S. WALKER.  
H. J. WILKINSON.  
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J. BACKHOUSE.  
C. E. ELMHIRST, *Secretary*.

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*Vice-Presidents* :

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*Secretary* : F. VEAR.

## KEEPER OF THE MUSEUM :

WALTER E. COLLINGE, D.Sc., M.Sc., F.L.S.

SUB-CURATOR : W. WATSON.

REPORT OF THE COUNCIL  
OF THE  
YORKSHIRE PHILOSOPHICAL SOCIETY,  
FEBRUARY 14TH, 1921.

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THE past year has been marked by no special event in the history of our Society. Our numbers have not only been maintained, but still further increased and now stand at 563, the highest figure ever reached.

We have received two interesting bequests, the first from one of our late Curators of Archæology, Mr. Thomas Boynton, of Norman House, Bridlington, who not only left us further specimens of his Yorkshire Pottery, which he had retained on making us his presentation in 1916 of the bulk of his Leeds ware, but now added his very extensive collection of flint implements found not only in the British Isles, but from such remote parts as Scandinavia, New Zealand, Mexico, North America, etc. The specimens filled some 60 drawers in his cabinets and have not yet been arranged for exhibition. The second bequest was from Mr. Robert Bielby Cook, late of 44, St. John's Street, York, and consists of two cabinets of coins, chiefly Roman and English, many having been found in York and its neighbourhood, and numbering 1,200; a further reference to this bequest will be found under Numismatics, p. xv, and your Council would tender its thanks to Mr. George Benson, who is one of the executors under Mr. Cook's will, for his good offices, not only in connection with the bequest but for cataloguing and arranging the coins.

The Yorkshire Philosophical Society is rapidly approaching its centenary, and your Council would remind its members of

The Council are sorry to have to draw attention to the fact that a considerable amount of damage has been done both in the Museum, and also in the grounds, particularly by children playing with balls against the walls and windows of the Hospitium, a large number of squares of glass having been broken which allows the rain and damp to penetrate on to the specimens inside. The Council particularly request that all the Members will co-operate with them in preserving the specimens and property of the Society from injury.

It is urgently requested that any discovery of Archæological interest in the neighbourhood may be brought to the notice of either the Chairman, Honorary Curators, or the Keeper of the Museum as early as possible.

The Keeper of the Museum will be pleased to give any information in his power, and may be seen daily, Museum engagements permitting.

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Postcards of many of the most important antiquities may be obtained in the Museum at 3d. each.



the events and circumstances which led to its foundation. In 1821, the discovery of the Kirkdale Cave near Kirbymoorside, disclosed a remarkable collection of the bones of the elephant, hippopotamus, rhinoceros, hyæna and others embedded in stalagmite on the floor of the Cave. These were divided between 3 York gentlemen, William Salmond, Anthony Thorpe and James Atkinson, and might have again been buried in their three private collections, had it not been for the suggestion of the Rev. William Venables Vernon, afterwards Archbishop Vernon Harcourt, that the Collection should be kept together and become the nucleus of a Yorkshire Museum. The suggestion was acted upon, and the donors and the Archbishop were the founders and first members of the Yorkshire Philosophical Society. The first meeting was held in 1822 and the first donation consisted of the contents of the Kirkdale Cave, which are still kept together in a large case in the Yorkshire Geological Gallery. The bones were identified and named by Professor William Buckland who wrote a book describing them called "*Reliquæ Diluvianæ*," their deposit in the Cave being at that date supposed to be the result of Noah's Flood. How the original founders were quickly joined by such celebrated scientists as Sedgwick, Waterton, Sir Humphrey Davy, Baron Humboldt and Professor Phillips, appears from our early Reports and Proceedings.

From 1822 to 1828 the Society occupied rooms in Low Ousegate adjoining Ouse Bridge, and in 1828, again largely owing to the exertions of Archbishop Harcourt, a Grant was obtained from the Crown of some 3 acres of land including the ruins of St. Mary's Abbey. A building fund was raised throughout the County amounting to £6,500 and the Museum was built and opened in 1830.

On the suggestion of Dr. Brewster, the British Association was founded by the members of the Yorkshire Philosophical Society in 1831, Viscount Milton, the then President of our Society, presiding at the first meeting. In recognition of this fact, the British Association has celebrated in the years 1856, 1881, and 1906, the 25th, 50th, and 75th anniversaries of its foundation in our City.

Your Council trust that in reminding our present members of these interesting facts, they may be stimulated to take an active part in celebrating the Centenary of the Society in 1922. Your Council would also note that in the same year 1922, our Sub-Curator, Mr. William Watson, will celebrate the Jubilee of his connection with our Society, he having commenced work in the Museum in 1872.

The past year has been an expensive one ; Major Allenby, who had long been tenant of St. Mary's Lodge, died in February last, and it was found that before the house could be again let, the roof would require very material expenditure, as the lead was worn out and had to be removed ; then the dilapidated tenement No. 1, Marygate, adjoining the Marygate Tower, which it partly concealed, came into the market, and your Council felt that it should be purchased and pulled down ; no sooner was this bought than the double-fronted shop 12, and 14, Bootham, lately occupied by Mr. Monkhouse, was advertised for sale, and after some discussion your Council decided to secure it if possible with a view eventually, when the supply of houses has once more caught up the demand, of disclosing a further portion of the most interesting 12th Century Abbey Wall which runs down the West side of Bootham.

Within the Museum, the Collections have been maintained in first rate order. The Skeleton Gallery has been painted, and the whole of the skeletons, birds and mammals have been cleaned and re-arranged and are now in course of re-labelling. Every credit is due to Mr. Watson and Miss Holmes for the manner in which this work has been carried out.

The following is a full list of the Lectures delivered in the Tempest Anderson Hall during the past year, and your Council rejoice that they are so well attended and appreciated :—

Thursday, January 8th.—“ Great Engineering Adventures.” By Edward Cressy.

Thursday, January 22nd.—“ Surgery of the War.” By Sir Cuthbert Wallace, M.B., B.S., London, F.R.C.S.

Thursday, February 5th.—“ The Gateway of England.” By Edgar Bellingham.

Thursday, February 19th.—“Through the Graian Alps from South to North.”

By G. Yeld, M.A. (late Vice-President of the Alpine Club).

Thursday, March 4th.—“Don Quixote.” By the Rev. Runnells Moss.

Thursday, March 18th.—“Baghdad.” By Canon Parfit.

Thursday, October 7th.—“Wireless Telegraphy.” By Thomas F. Finucane.

Thursday, October 21st.—“Afganistan and its People.” By Ikbal Ali Shah.

Thursday, November 4th.—“The Romance of Peru.” By the Rev. Waldy Skinner.

Thursday, November 18th.—“The Uncrowned King of Arabia.” (Col. T. E. Lawrence). By Capt. Laurence M. Gotch.

Thursday, December 2nd.—“Visits to Volcanoes.” By G. Yeld, M.A.

Thursday, December 16th.—“English Architects in the Middle Ages.” By A. Hamilton Thompson.

The Papers read at the Monthly Meetings were as follows :—

Monday, October 11th, 1920.—“A few Astronomical Instruments.” By John Scott.

Monday, November 8th, 1920.—“The Council of the North.” By G. Benson, A.R.I.B.A.

Your Council experience the greatest difficulty in maintaining the supply of these papers and those given have been miserably attended.

The Society has lost by death and resignation 35 Members, 11 Lady Subscribers, and 3 Associates, whilst 80 new Subscribers have joined the Society.

The Council recommend that Dr. W. A. Evelyn, The Rev. W. Johnson, Mr. Philip Newman, and Mr. John Scott be new members of Council in the place of those retiring by rotation.



ARCHÆOLOGY.—The Hon. Curator of the Architectural Museum is pleased to be able to report that a few interesting additions have been made to the Collection, ranging from the late Saxon period as illustrated by the head of a cross, much mutilated, but exceedingly characteristic, from a garden in Heworth; further portions of a fine doorway of the middle Norman, or as it really should be called, Romanesque style, to a group of stones from a garden in Mount Vale which cover the period from the late Norman to the Decorated; amongst them another piece of the richly carved string course over the wall-arcade from the demolished chapel of St. William on Ouse Bridge, thus making three new pieces from different sources

which the curator has been able to add to the Collection since the Architectural Museum was formed in 1912, 1913.

Another fine detail which will appeal strongly to all lovers of the Decorated period of architecture, is a large panel contained in a bold quatrefoil moulding of two figures fighting—this, upon the first sight of it the curator recognised as being one of the four quatrefoil panels from the interior west wall of the nave of York Minster, removed evidently upon the restoration of the nave after the fire of A.D. 1840, and replaced by a new and carefully executed replica of the old panel now in our Collection—this has been verified by two sketches which corroborate one another. The curator would like to draw the inference from this unexpected find, and also to ask members and lovers of architecture in York and the neighbourhood to do the same, that there is undoubtedly a mass of unrecognised pieces of carving in the way of corbels, figures, mouldings, &c., &c., of the very greatest interest and value lying on, under, and in rockeries, in the gardens attached to so many houses in York.

Several appeals have been made for spontaneous gifts of this kind, but with a few notable exceptions, *no* response has been met with. The curator has spent much time and money in the acquisition of dozens of new pieces of sculpture, &c., and in cartage and in the payment to contractors and others, in order to increase the interest of the Collection, and he feels that he is entitled to ask for the support of all who are interested in this work: he has placed as gifts of individuals some pieces which he has purchased himself, and he regrets to find a general apathy on the subject and is afraid that the interest flags when the gift entails a little self denial. At any rate, he would feel much encouraged if the residents in Bootham, the Mount and Holgate, and other districts, would look round their gardens and rockeries and try to conquer the love of possession for the general good and advancement of one of the most fascinating of all the “ologies”—Archæology. There can be no more pious work than giving honour to those old artists, architects, and masons, by treasuring these evidences of their immortal glory which have survived the religious fury of the sixteenth and seventeenth centuries, and the restorers of the



nineteenth. Let us try once again by unselfish and whole-hearted co-operation to make the Collection more worthy of the Museum of the second city in the realm.

**BOTANY.—*Herbarium***—The specimens of British plants in the Herbarium are in good condition but the Foreign specimens require attention.

**Garden**—I regret to report that wilful damage has been done (during 1920) to the plants in the Botanic Gardens. I trust that the Council will provide efficient supervision to prevent such destruction. I am pleased to record that during the months of July, August and September many visitors in addition to members visited the Botanic Garden. I have to thank Mr. George Webster and Members of the York and District Field Naturalists' Section of the Yorkshire Philosophical Society for their assistance.

**Donations**—Specimens of British plants from the late Mr. Charles Wakefield. (1406 B) *Spartina Townsendii*, H. and J. Groves from near Poole, Dorset., Oct. 1920, presented by J. S. Gayner, Esq.

**CERAMICS.**—The Ceramic Collection has been maintained in an efficient state during the year. A good many additions have been made to the Loan Collections in the Hall during the year, particularly in the Leeds section. The work of cataloguing the Collection is now in hand.

**CONCHOLOGY.**—The Collections of Foreign Marine, British Marine, and Foreign Non-Marine Shells I find to be in good order. As regards the British Non-Marine (Land and Fresh Water) Collection I find some of the species are represented by specimens which are very much bleached, no doubt owing in the main to their long exposure, and the action of light upon their fugitive colours, and need replacing, as the specimens exhibited do not do justice to the character and beauty of the species they represent. I would also venture to take this opportunity to suggest that I think it would be a decided improvement if the Collection of Shells of the British Land and Fresh Water Mollusca were exhibited grouped together instead of as at present in a long narrow row at the top of one

of the centre cases where many of the species, owing to their diminutive size, cannot be properly seen and examined. They thus lose much of the attention and admiration they are entitled to, and no doubt would receive, if they were arranged under more favourable conditions.

ENTOMOLOGY.—Considerable progress has been made during the year in the cabinet arrangement to receive the type Collection of British Lepidoptera for general purposes. All the Entomological Collections have been maintained in good order.

GEOLOGY.—The re-arrangement and re-labelling of the minerals of the Collections have now been satisfactorily completed. Pleistocene fossils have been presented to the Museum by Mr. A. Bell; a descriptive paper appears in this report. The examination of fossils of Tertiary age, illustrating the flora of the period, is being continued by Professor J. Johnson, D.Sc., of Dublin, and a detailed report may soon be expected.

METEOROLOGY.—*Statistics of Station*: Longitude,  $1^{\circ} 5' \text{ W.}$ ; Latitude,  $53^{\circ} 57' \text{ N.}$ ; height above mean sea level, 56 feet.

The weather of 1920 was distinctly unfavourable to cereals, though the crops of hay and of roots were much heavier than in the previous year. Little favourable weather came during the general holidays, and most unpleasant memories are retained of vain attempts at excursions and out of doors gatherings.

*Temperature* ranged in 1920 between  $25^{\circ} \text{ F.}$  on Dec. 9th and  $78^{\circ} \text{ F.}$  on June 18th, the range of temperature being thus  $53^{\circ}$  as against  $65^{\circ}$  for 1919. A mean pressure of 1014.5 millibars (1000 millibars = 29.531 mercury inches) at M.S.L., corrected for diurnal variations, has been recorded in 1920 as against 1013.0 mbs. for 1919. April was lowest with 1004.6 mbs., January next with 1008.6 mbs. February was highest with 1020.2 mbs., August next with 1018.0 mbs., and June and November with 1016.9 mbs. The extreme range was 71.6 mbs. as compared with 68.7 mbs. in 1919, and 54.5 mbs. for 1918. The highest reading of the barometer was taken on

February 5th at 9 a.m., viz.: 1039·8 mbs., and the lowest on March 15th at 9 a.m., viz.: 968·2 mbs.

*Rain or Snow* fell to the amount of 26·10 inches (or 663 mms). The heavy rainfall of the year fell in July (147 mms.), April (60 mms.), June (57 mms.), the cumulative total for February and March being only 69 mms. The rainfall for this district was thus 59 mms. above that of the previous year. The heaviest fall of rain occurred on June 18th, when 34 mms. fell. The cumulative totals since 1820 are, for the heaviest months, now:—August 5355 mms., October 5333 mms., and July 5081 mms.

Observations of winds show that during 1920 we have had “strong” winds on 38 days as against 26 days for 1919, and “calm” on 16 days as against 22 days for 1919. The chief winds have been observed as S. (279), S.W. (166), N. (165), W. (145), E. (86), N.W. (82). We have had 37 days of “clear” sky, and 139 days “overcast,” as compared with 56 days of “clear” and 139 days “overcast” for 1919. Harvest was late, and protracted, and much of the grain was gathered in a damaged condition, and the outlook for Agriculture changed for the worse.

There have been 8 thunderstorms and 15 fogs as compared with 5 and 20 respectively for 1919. Snow fell on 10 days as compared with 16 and 15 days for 1919 and 1918 respectively. There were hailstorms on 5 days.

*Bright Sunshine* was recorded for 1081 hours as against 1201 hours for 1919, a decrease of 120 hours for the year, representing a percentage reduction for 27 % in 1919 to 24 % in 1920.

MINERALOGY.—The Hon. Curator reports that the work of cleaning and re-labelling the Collection has now been completed.

NUMISMATICS. India. Mr. H. C. Barstow presented in 1905 a Collection of Indian coins consisting of 56 gold, 145 silver, and 129 bronze. The gold series begin with a coin of Euthydenus I., King of Bactria who ruled some 220 years before the Christian era. This coin is circular, and bears the King's head, and on the reverse Herakles bearded, naked, and

seated between a Greek inscription. Alexander the Great had successfully invaded India some years previously. The silver coins begin with one of Eucratides who lived in the second century before Christ, and the coin bears the King's bust with helmet, and on the obverse the Dioscuri charging with long lances. There is a square bronze coin of this King whose bust is surrounded on three sides by a Greek inscription, whilst the Dioscuri are between Indian lettering. Another square bronze coin was issued by Apollodotus, and bears Apollo with bow and arrow and an inscription in Greek, whilst the reverse has a tripod on a stand within a dotted square and an Indian inscription. There are three silver coins of Meander with the King's bust and Pallas on the reverses. A bronze coin of Hermaeus, B.C. 40, bears his bust, and on the reverse Zeus seated. There are gold coins of the Gupta dynasty.

The Turks under Muhammad Ghorî conquered the district. These Mahomedan rulers dispensed with portraits on their coins, relying on arabesque ornament and characters.

There are coins of the Mogul Emperors of Delhi who ruled in the 16th century, and whose architecture is such a distinctive feature in India. The Zodiac series of coins of Ichangar is represented by one of Piscis.

A gold coin of Nadir Shah, the Persian who sacked Delhi in 1742, is said to be unique as is also one of Ahmud Shah.

The Collection has been seen by Mr. John Allan, the well-known authority on Oriental coins.

Mr. Barstow presented the following books relating to the coins :—

The Chronicles of the Pathan Kings of Delhi, by Edward Thomas, 1871. 6 plates of coins.

The Coins of the Muhammedan States of India, by S. L. Poole, Brit. Mus., 1885. 12 plates of coins.

The Coins of the Greek and Scythic Kings of Bactria and India, by Percy Gardner, Brit. Mus. 32 plates of coins.

The Trustees of the British Museum have presented the following :—

Catalogue of Persian Coins, by R. S. Poole, 1887.

Catalogue of the Coins of the Moghul Emperors, 1892.

Catalogue of the Coins of the Gupta Dynasties, 1914.

During the year Mr. Barstow has added to the Collection a large number of bronze coins.

The Yorkshire Numismatic Society held a meeting in the Museum on April 17th, 1920, when the Indian Collection of Coins was shown and described by the donor, Mr. H. C. Barstow.

*The Cook Bequest of Roman and English Coins.*

Robert Bielby Cook, of 44 St. John Street, York, who died on May 29th 1919, in his Will, wrote: "I bequeath to the Yorkshire Philosophical Society my Collections of Old Coins, chiefly Roman and English, formed by my father, Robert Cook, and myself, and containing many specimens found in York and its neighbourhood, on condition that the same Collections be kept together as nearly as possible in their present condition, and known as the 'Robert Cook Collection.' " The coins are contained in two cabinets:

I. Cabinet 14½ in. × 13½ in. × 11 in. with 22 slides (2 trays in the bottom one). It contains 574 *Roman* coins, including 18 Family silver, 15 *British and Gaulish*—1 gold—Roman silver 114 with large, middle and small brass, and 2 *Byzantine* coins.

II. This Cabinet measures 14 in. × 14 in. × 17 in. and contains 6 drawers of *English* coins.

1. Edward VI. crowns, 1551 and 1552, the former was the first year in which crowns were struck. Crowns of Elizabeth, 1601; Charles I—Exeter mint, Commonwealth 1653, and George III. Dollar, Bank of England—1804, Nuremberg tokens etc.

2. Two trays *Stycas*, lower 115, upper 66, total 181, including coins from the Cuerdale Find; coins of the Archbishops of York and Kings of England.

3. *Half-groats*. 196 coins, Edward III. to Victoria.

4. Seventeen double glazed tablets to show both sides of coins numbering 196:—

I. 6 English halfpennies.

II. 6 Ditto one found in Monkgate.

III. Farthing found in York, June, 1848, Henry IV., V., or VI.

IV. Northumbrian gold coin found in York, 1848—a similar one was found with it and was in the Bateman Collection.

- v. Two rare sceattæ.
- vi. White's silver counterfeit, Richard I.
- vii. 12 silver, Henry III. and John.
- viii. 6 „ Henry I. to John.
- ix. 26 „ pennies, William I.
- x. 28 „ „ William I.
- xi. 18 „ „ William II.
- xii. 18 „ „ William II.
- xiii. 28 „ „ Edward I.
- xiv. 18 „ Richard II. to Edward IV.
- xv. 18 „ Henry VIII. to Charles II.
- xvi. Halfpenny, Henry VIII.
- xvii. Farthing, Edward III., Charles I siege money—a diagonal shilling.

*Medals*—Bronze Coronation Edward VII., silver do., Rowntree's do. York Minster 1829, in box of Minster oak.

5. Three trays, total 117; lowest 25 gold; middle 47 shillings—Henry VIII. to George I.; and top 45 sixpences—Edward VI. to George V.

6. Three trays containing 113 coins, namely: lowest tray, 35 crowns, half-crowns, and florins; middle tray, 32 half-crowns from Edward VI. to George II.; top tray, 46 groats Edward III. to Victoria.

The "Robert Cook Collection" has been inspected by Mr. John Allan, of the British Museum.

The following works in connection with the above were also presented:—

Medallic History of Rome, Vols. I. and II.; Smith on Roman Medals, Pinkerton's Essay on Medals, 1808; Catalogues Coin Sales 1830—45, including that of Wm. Benson, of Bury, Aug. 18th, 1845, and three following days; 1839—40, Young's Catalogues; 1846—48, 1846—50, Campana and Brummell's Catalogue; MS. Catalogue English Silver Coins, R. B. Cook, Scarborough; MS. Catalogue of Roman Coins, with Note on Coin of Allectus found in Tanner Row, April 18th, 1850; Essay on Numismatic History of the East Angles, 1845, 22 pp. 5 plates; Newspaper cuttings—Y.P.S. Meetings, including

1845, June, Pennies of William I. found in Jubbergate—1846, Stycas, Bolton Percy, p. 26,—1856, Ancient York Mint, p. 8. Coinage of the Normans and the House of Blois, Ratcliff, 1897, 24 pp. Catalogues: Capt. Warren, Southsea, 31 pp.; Borrell, 1851; Boocke, 1850; Chaffers junior, 1851; Silburn, Pocklington, 1854; Benwell, 1849; C. E. Simpson, 1903; Cureton, 1852; Dr. Neligen, 1851; C. D. Wolstenholme, 1878, and English Coins.

THE OBSERVATORY.—All the instruments are in good repair and adjustment. The sidereal clock is now keeping good time. A good number of observations have been taken during the year, but very few members avail themselves of the privilege of looking through the telescope. On October 9th, 1920, the Leeds Astronomical Society visited the Observatory, and a paper on "Astronomical Instruments," illustrated with lantern slides, was given by the curator in the Tempest Anderson Hall. The Observatory will be open for members to see through the telescope on all lecture nights, providing it is clear, and at any other time by arrangement with the curator.

ZOOLOGY.—The work of casing and arranging of the small birds, presented or purchased and previously mentioned, has since been carried out. The Bird Collection is now much more complete than ever before, but there are still several species not yet represented, and which are resident or of migratory occurrence in Yorkshire. The Collections generally speaking are in good order.

FIELD NATURALISTS' SECTION.—Rambles were held during the season to Sandburn Woods, Clifton Ings, Askham Bogs, Kirkham Abbey, Bishopthorpe, Backhouse's Nursery, Hob Moor.

Special mention must be made of Mr. J. Hetherton's generosity in placing a wood of considerable area at the disposal of the Society to be used as a bird sanctuary. Fifteen nesting boxes have been fixed in various parts of the wood.

The winter programme has been a successful one comprising 7 illustrated lectures, and 12 lecturettes.





NORMAL CLIMATOLOGICAL STATION, YORK.—THE MUSEUM.

Latitude 53° 57' N., Longitude 1° 5' W. Gravity Correction + 0.8 mb. Height above Mean Sea Level 56 ft.

1920.	Mean Pressure and Lat. 45° corrected to 32° F.			Temperature		Humidity.				Amount of Cloud. 0—10.		Number of days of		Wind, No. of Observations referred to a total of 93, 90, 87 or 84 for the month.											
	Station Level.	M.S.L. and corrected for diurnal variation.	Mean.  ins.	9 a.m. 9 p.m.		Depression of Wet Bulb.		Vapour Pressure.		Percentage.		9 a.m.	9 p.m.	Clear Sky.	Overcast.	Wind Force 8 and above (4—7)	Calm.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
				°	°	9 a.m.	9 p.m.	°	°	mb.	mb.														
Jan.	1006.9	1008.6	29.684	39.4	40.6	1.8	2.4	7.0	7.0	mb.	mb.	86	82	3	6	0	8	3	6	1	5	30	20	21	6
Feb.	1018.4	1020.2	29.721	40.0	42.3	1.8	2.2	7.1	7.5	7.5	8.4	86	84	2	6	0	5	12	2	0	1	30	23	15	3
Mar.	1008.4	1010.1	29.702	43.9	43.9	2.3	2.0	8.1	8.2	8.2	8.5	83	85	6	12	0	5	9	1	0	8	30	15	17	12
April	1002.9	1004.6	29.562	45.3	45.3	2.3	2.1	8.5	8.6	8.6	8.4	83	84	0	20	0	2	14	10	12	6	17	6	12	13
May	1013.8	1015.5	29.903	52.8	52.5	3.4	3.4	10.5	10.4	10.4	7.8	77	78	6	11	0	8	9	3	8	7	15	24	17	9
June	1015.2	1016.9	29.946	59.1	56.5	5.3	4.1	11.8	11.6	11.6	7.4	70	74	6	7	0	0	9	17	20	4	9	7	15	9
July	1009.0	1010.7	29.784	57.4	56.8	3.2	2.7	12.8	13.0	13.0	8.3	80	83	0	13	0	0	16	2	3	0	32	19	12	9
Aug.	1016.3	1018.0	29.980	55.9	56.1	3.3	3.0	12.1	12.4	12.4	8.1	80	81	0	14	0	0	32	3	0	4	12	20	7	9
Sept.	1014.2	1015.9	29.953	53.4	54.3	2.1	2.2	11.9	12.2	12.2	8.5	86	85	5	7	0	0	13	0	3	4	20	12	23	9
Oet.	1014.2	1015.9	29.948	48.5	49.1	1.5	1.6	10.3	10.5	10.5	8.9	89	89	4	12	0	2	4	13	29	25	18	0	2	2
Nov.	1015.2	1016.9	29.974	44.1	43.7	1.6	1.7	8.6	8.3	8.3	8.6	87	86	4	16	0	6	14	4	4	14	36	17	1	0
Dec.	1012.8	1014.5	29.893	38.4	39.0	1.2	1.2	7.1	7.2	7.2	9.0	90	90	1	15	0	2	30	6	6	14	30	3	3	1
Totals														37	139	0	38	16	67	86	92	279	166	145	82
Year Means	1012.3	1014.0	29.846	48.2	48.4	2.5	2.4	9.7	9.7	9.7	8.3	83	83												

Pressure is expressed in millibars (1000 millibars = 29.531 mercury inches), also in mercury inches.

RIVER HEIGHT RECORDS REGISTERED BY THE AUTOMATIC RECORDER  
AT THE GUILDHALL, YORK, 1920.

Date.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
1	7 a.m.	above 6 11	3 p.m.	above 8 6	12 p.m.	above 1 2	1 a.m.	above 2 4	noon	above 1 5	1 a.m.	above 1 7
2	1 a.m.	4 7	1 a.m.	7 7	1 a.m.	1 2	12 p.m.	2 8	12 p.m.	4 2	"	1 2
3	"	1 11	"	4 6	noon	0 10	3 p.m.	4 0	7 a.m.	5 4	"	0 10
4	"	1 7	11 p.m.	3 8	1 a.m.	0 10	2 p.m.	4 8	1 a.m.	3 3	"	0 8
5	8 p.m.	1 1	1 a.m.	3 8	noon	0 9	2 a.m.	4 6	"	3 0	2 a.m.	0 7
6	noon	1 4	"	2 2	1 a.m.	0 8	1 a.m.	2 11	noon	2 10	noon	0 5
7	1 a.m.	1 3	"	1 6	12 p.m.	1 2	"	2 5	2 p.m.	4 3	"	0 5
8	12 p.m.	5 9	"	1 3	2 a.m.	1 3	2 p.m.	2 10	1 a.m.	3 5	"	0 5
9	7 a.m.	6 8	"	1 0	1 a.m.	0 8	1 a.m.	2 7	"	2 1	1 a.m.	0 5
10	1 a.m.	3 10	12 p.m.	7 6	"	0 6	12 p.m.	5 0	"	1 4	noon	0 4
11	12 p.m.	9 8	8 p.m.	10 6	12 p.m.	1 0	"	7 6	"	0 11	"	0 4
12	"	11 7	1 a.m.	10 3	6 a.m.	1 0	3 p.m.	8 0	6 a.m.	0 8	"	0 4
13	1 a.m.	11 7	"	4 9	8 p.m.	2 1	9 p.m.	7 10	6 p.m.	0 9	12 p.m.	0 5
14	"	9 10	9 a.m.	4 8	9 p.m.	2 0	1 a.m.	7 9	noon	0 9	9 p.m.	0 8
15	"	6 6	1 a.m.	3 7	12 p.m.	2 2	"	6 5	1 a.m.	0 9	noon	0 4
16	"	3 10	9 p.m.	2 11	6 p.m.	2 9	12 p.m.	7 8	"	0 5	10 a.m.	0 5
17	"	3 3	1 a.m.	2 10	12 p.m.	3 0	3 a.m.	7 8	noon	0 3	noon	0 3
18	3 p.m.	5 6	"	1 8	9 a.m.	4 10	1 a.m.	5 9	"	0 3	12 p.m.	0 4
19	1 a.m.	4 8	"	1 6	1 a.m.	4 3	"	2 11	12 p.m.	4 11	"	0 5
20	"	4 8	12 p.m.	2 7	"	1 11	12 p.m.	2 7	7 a.m.	6 4	"	0 7
21	"	2 11	1 a.m.	2 7	"	1 1	9 p.m.	3 4	1 a.m.	3 1	"	0 8
22	"	2 4	"	2 0	"	0 10	2 a.m.	3 5	"	1 2	noon	0 8
23	12 p.m.	2 6	12 p.m.	1 8	noon	0 8	9 p.m.	3 1	"	0 11	"	0 8
24	6 p.m.	2 8	4 a.m.	1 1	11 a.m.	0 8	1 a.m.	3 1	"	0 9	"	0 7
25	1 a.m.	1 10	1 a.m.	1 3	12 p.m.	3 10	10 p.m.	2 4	noon	0 8	"	0 8
26	"	1 10	noon	0 10	2 a.m.	4 0	1 a.m.	2 4	"	0 7	"	0 8
27	12 p.m.	1 8	"	0 9	7 p.m.	5 5	"	1 7	12 p.m.	0 10	"	0 8
28	10 p.m.	2 8	6 p.m.	0 11	8 p.m.	5 3	noon	1 5	6 a.m.	0 10	1 a.m.	0 8
29	12 p.m.	3 8	1 a.m.	0 10	1 a.m.	5 2	"	1 5	noon	0 8	12 p.m.	0 1
30	"	5 0	"	0 10	3 a.m.	4 7	"	1 5	12 p.m.	3 3	11 a.m.	0 4
31	11 a.m.	5 10	1 a.m.	3 2	1 a.m.	3 2	"	1 5	3 a.m.	3 4	"	"

## RIVER HEIGHT RECORDS.

Date.	JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.	Time.	Above or below S.L.
1	12 p.m.	ft. in. S.L.	1 a.m.	ft. in. above 0	4 p.m.	ft. in. below 0	1 a.m.	ft. in. below 0	12 p.m.	ft. in. above 0	12 p.m.	ft. in. above 0
2	"	above 0	"	0	6 p.m.	0	12 p.m.	above 0	3 p.m.	0	4 a.m.	1
3	9 p.m.	11	"	0	"	0	noon	0	1 a.m.	0	12 p.m.	5
4	12 p.m.	6	12 p.m.	0	"	S.L.	12 p.m.	1	"	0	noon	7
5	6 p.m.	3	"	5	"	S.L.	5 p.m.	6	"	0	1 a.m.	6
6	1 p.m.	3	5 a.m.	5	10 p.m.	below 4	1 a.m.	5	6 p.m.	0	"	4
7	1 a.m.	2	1 a.m.	7	1 a.m.	4	"	3	noon	0	"	2
8	12 p.m.	1	"	2	"	4	"	2	1 a.m.	0	"	1
9	noon	4	"	0	"	4	"	0	9 a.m.	0	"	3
10	4 p.m.	3	"	8	"	3	"	0	noon	0	12 p.m.	0
11	1 a.m.	3	"	6	"	0	"	0	6 p.m.	0	noon	0
12	"	3	noon	7	"	0	"	0	1 a.m.	0	"	0
13	"	1	"	6	11 a.m.	0	noon	0	noon	0	12 p.m.	0
14	3 p.m.	5	1 a.m.	0	6 p.m.	S.L.	1 a.m.	0	3 p.m.	1	noon	0
15	1 a.m.	0	12 p.m.	0	12 p.m.	above 0	"	0	12 p.m.	8	12 p.m.	1
16	12 p.m.	0	1 a.m.	0	"	0	noon	3	5 a.m.	8	noon	1
17	"	2	12 p.m.	0	12 p.m.	0	4 a.m.	3	1 a.m.	5	1 a.m.	0
18	2 p.m.	3	1 a.m.	0	6 p.m.	0	1 a.m.	1	"	3	noon	0
19	1 a.m.	2	4 p.m.	0	noon	0	"	0	"	1	"	0
20	"	1	1 a.m.	0	1 a.m.	0	"	0	"	5	"	0
21	6 p.m.	0	"	0	"	0	noon	0	"	2	noon	0
22	12 p.m.	0	"	0	12 p.m.	0	"	0	"	1	12 p.m.	5
23	"	2	noon	0	noon	0	1 a.m.	0	"	0	6 a.m.	5
24	noon	5	5 p.m.	0	1 a.m.	0	noon	0	"	0	1 a.m.	4
25	1 a.m.	3	11 a.m.	0	"	0	"	0	noon	0	"	1
26	12 p.m.	3	noon	0	noon	0	1 a.m.	0	1 a.m.	0	12 p.m.	3
27	9 a.m.	4	"	0	1 a.m.	0	noon	0	"	0	1 a.m.	2
28	1 a.m.	2	9 a.m.	0	noon	S.L.	1 a.m.	0	12 p.m.	0	"	1
29	"	1	noon	S.L.	"	S.L.	"	0	6 p.m.	0	12 p.m.	2
30	"	1	1 a.m.	S.L.	1 a.m.	S.L.	"	0	12 p.m.	1	"	7
31	noon	0	noon	below 0	"	S.L.	"	0	3 a.m.	5	"	8
		10		1		1		1		7		7

AT CHERRY HILL, YORK.

Rain Gauge : Dia. of Funnel, 5 in.;  
Height Above Ground, 1ft. 6in.  
" Above Sea Level, about 50ft.

BRIGHT SUNSHINE. (Bootham School)		Barometer at Mean Sea Level					
Year.	Daily* Mean.		Absolute.				Date.
	1920	Per- centage. 1920 1919	Highest.	Highest.	Lowest.	Lowest.	
	Hours.	%	mb.	ins.	mb.	ins.	
Jan.	1·65	21	8	1037·7	30·550	5th, 9 p.m.	11th, 9 p.m.
Feb.	2·28	24	12	1039·8	30·611	5th, 9 a.m.	11th, 9 a.m.
Mar.	2·71	23	22	1033·7	30·434	2nd, 9 p.m.	15th, 9 a.m.
Apr.	2·23	16	26	1022·4	30·057	23rd, 9 p.m.	15th, 9 p.m.
May	5·61	35	45	1032·8	30·407	5th, 9 a.m.	18th, 9 p.m.
June	6·37	37	33	1027·6	30·255	23rd, 9 p.m.	29th, 9 a.m.
July	3·45	21	21	1023·3	30·132	19th, 9 p.m.	23rd, 9 p.m.
Aug.	3·26	22	38	1033·7	30·437	29th, 9 a.m.	5th, 9 a.m.
Sept.	3·17	25	33	1027·3	30·255	24th, 9 a.m.	18th, 9 p.m.
Oct.	3·10	30	33	1030·9	30·352	25th, 9 p.m.	31st, 9 p.m.
Nov.	0·90	11	14	1033·3	30·421	22nd, 9 a.m.	15th, 9 a.m.
Dec.	0·71	10	16	1033·7	30·434	5th, 9 a.m.	21st, 9 p.m.
Year.	2·95	24	27	1039·8	30·611	Feb. 5, 9 a.m.	28·507 Mar. 15, 9 a.m.

The Barometer readings are expressed in millibars (1000 millibars = 29·531 mercury inches),  
also in mercury inches.

\* For Monthly Totals see Form 3211.

Month.	Total Depth.	Greatest Fall in 24 hours.		Number of Days with '01 or more recorded
	Inches	Inches	Date	
Jan.	2·73	·79	28	15
Feb.	1·08	·57	19	8
Mar.	1·98	·59	14	13
April	3·19	·40	19	19
May	2·20	·26	27	12
June	2·63	1·35	18	8
July	5·81	·96	16	17
Aug.	1·31	·99	5	6
Sept.	1·03	·27	15	10
Oct.	2·08	1·10	4	8
Nov.	1·03	·12	29	10
Dec.	2·25	·46	29	18
Total	27·32			144

THE TREASURER'S ACCOUNT IN CONNECTION WITH THE FUND FOUNDED BY THE LATE  
WM. REED, ESQ., FOR SPECIFIC PURPOSES.

Dr.	INCOME.		EXPENDITURE.		Cr.
	£ s. d.		£ s. d.		
Interest on York Corporation 3% Redeemable Stock, less tax ... ..	...	12 12 0	Nil. ... ..	...	...
Interest on £50 on Deposit with the London Joint City and Midland Bank Ltd. ... ..	...	1 5 0			
Bank Interest on Current Account ... ..	...	2 0 0	Excess of Income over Expenditure ... ..	...	15 17 0
	<hr/> £15 17 0 <hr/>				<hr/> £15 17 0 <hr/>

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BALANCE SHEET.

	£ s. d.			£ s. d.	
Amount of Fund on 31st December, 1920 ... ..	...	727 10 9	Amount invested in York Corporation 3% Redeemable Stock ... ..	...	600 0 0
			Amount placed on Deposit with the London Joint City and Midland Bank Ltd. ... ..	...	50 0 0
			Balance in Bank ... ..	...	77 10 9
	<hr/> £727 10 9 <hr/>				<hr/> £727 10 9 <hr/>

Audited and found correct,

EDWIN GRAY, *Hon. Treasurer.* PHILIP L. NEWMAN.

11th February, 1921.

## THE TREASURER IN ACCOUNT WITH THE YORKSHIRE

Last Year.	Dr.	INCOME.						£	s.	d.	£	s.	d.
	Subscriptions:												
	Town Members	...	...	...	...	...	698	0	0				
	Country Members	...	...	...	...	...	15	0	0				
	Temporary Members	...	...	...	...	...	1	0	0				
	Lady Subscribers	...	...	...	...	...	92	0	0				
	Associates	...	...	...	...	...	28	0	0				
	Arrears received	...	...	...	...	...	64	15	0				
	Keys of Gates	...	...	...	...	...	83	17	6				
943											982	12	6
	Rents:												
	St. Mary's Lodge ( $\frac{1}{2}$ year)	...	...	...	...	...	32	10	0				
	Marygate Baths	...	...	...	...	...	40	0	0				
	Shop, No. 10 Bootham (9 months)	...	...	...	...	...	18	15	0				
	York Waterworks Co.—Shed	...	...	...	...	...	15	0	0				
	Do. Light	...	...	...	...	...	0	1	0				
	Corporation of York, Lease of Exhibition Land	...	...	...	...	...	2	0	0				
	Post Office—Wayleaves	...	...	...	...	...	1	2	0				
	York Diocesan Training College, Boat Yard	...	...	...	...	...	5	0	0				
	Letting of Rooms for Lectures and Meetings	...	...	...	...	...	114	0	0				
261											228	8	0
	Dilapidations at St. Mary's Lodge:												
	Executors of late Major Allenby	...	...	...	...	...	...	...	...		100	0	0
	The late Dr. Tempest Anderson's Bequest:												
	Interest on £8,000 New Zealand 4 % Inscribed Stock	...	...	...	...	...	224	0	0				
	„ on £3,200 Great Eastern Railway 4 % Preference Stock	...	...	...	...	...	89	12	0				
	„ on £5,000 North Eastern Railway 4 % Preference Stock	...	...	...	...	...	140	0	0				
	„ on £8,000 Canada 4 % Stock	...	...	...	...	...	224	0	0				
	„ on £3,219 3s. 5d. Bank of England Stock	...	...	...	...	...	225	6	10				
	„ on £5,777 2s. 6d. South Indian Railway 4 % Registered Debenture Stock	...	...	...	...	...	161	15	2				
	„ on £3,368 8s. 5 % War Loan Stock	...	...	...	...	...	168	8	4				
	„ (part of year) on £2,000 6 % Exchequer Bonds (now converted as per next item)	...	...	...	...	...	60	0	0				
	„ (part of year) on $5\frac{3}{4}$ % Exchequer Bonds	...	...	...	...	...	40	5	0				
	Rents of Shops and Dwelling-houses, Nos. 32 and 34 Bootham	...	...	...	...	...	60	0	0				
	Income Tax recovered for 1 year	...	...	...	...	...	456	6	0				
2583	(Included 3 years Income Tax recovered.										1849	13	4
	Memo: The above items are shown less tax, if deducted												
	Whitsuntide Admission Fees	...	...	...	...	...	26	1	6				
	Less: Attendants	...	...	...	...	5 5 0							
	Fixing and removing barriers	...	...	...	...	2 11 3							
											7	16	3
5	Sale of Reports, Books and Plans	...	...	...	...	...					18	5	3
25	Bank Interest on Current Account	...	...	...	...	...					12	5	2
269	Gate Money	...	...	...	...	...					18	15	0
19	Interest on £918 8s. 9d. India 3 % Stock	...	...	...	...	...					342	5	10
	(the late Mr. Rawdon's Bequest)												
5	Grant from Corporation of York towards Meteorological Department	...	...	...	...	...					19	6	0
25/-	Acknowledgments for Keys of Bowling Green Lockers (for yr. 1919)	...	...	...	...	...					5	0	0
5	Interest on £100 5 % War Loan Stock	...	...	...	...	...					1	10	0
											5	0	0
	Excess of Expenditure over Income	...	...	...	...	...					£3583	1	1
											1321	18	8
											£4904	19	9
	Excess of Expenditure over Income 1920	...	...	...	...	...							
	Balance in hands of the Treasurer, 31st December, 1919	...	...	...	...	...					1321	18	8
											980	15	1
											£341	3	7

EDWIN GRAY, *Hon. Treasurer.*Audited and found correct, PHILIP L. NEWMAN.  
11th February, 1921.

PHILOSOPHICAL SOCIETY FOR THE YEAR ENDING 31ST DEC., 1920.

<i>Last Year.</i>	<b>EXPENDITURE.</b>							<b>£</b>	<b>s.</b>	<b>d.</b>	<b>Cr. £ s. d.</b>
	Crown Rent ... ..	...	...	...	...	...	...				1 0 0
	Corporation Rent ... ..	...	...	...	...	...	...				14 15 0
	<i>Rates and Taxes:</i>										
	Property Tax and City Rates ... ..	...	...	...	...	...	...	112	10	9	
	Waterworks Company's Rates ... ..	...	...	...	...	...	...	6	18	2	
	Gardeners' Licenses ... ..	...	...	...	...	...	...	3	0	0	
122	Receipt and Cheque Books Stamping ... ..	...	...	...	...	...	...	5	10	3	127 19 2
	<i>Insurance:</i>										
	Fire Premiums ... ..	...	...	...	...	...	...	14	3	0	
	Employers' Liability Premiums ... ..	...	...	...	...	...	...	6	2	8	
26	National Health and Unemployment Insurance ... ..	...	...	...	...	...	...	9	14	9	30 0 5
8	Telephone Rent and Calls ... ..	...	...	...	...	...	...				7 16 4
	<i>Salaries and Wages:</i>										
	Museums ... ..	...	...	...	...	...	...	933	4	0	
1579	Lodge and Gardens ... ..	...	...	...	...	...	...	626	10	0	1559 14 0
	<i>General Additions, Repairs, and Expenses:</i>										
	MUSEUMS—										
	Painting and the like ... ..	...	...	...	...	...	...	107	12	9	
	Joiners', Cabinetmakers', Plumbers', Glaziers' and like work ... ..	...	...	...	...	...	...	29	13	6	
	Taxidermy Work & Purchase of Birds ... ..	...	...	...	...	...	...	21	3	9	
	Antiquities, Coins, Pottery, & the like ... ..	...	...	...	...	...	...	6	15	6	
794	Other Additions, Repairs, & Expenses ... ..	...	...	...	...	...	...	48	17	8	
								214	3	2	
	ESTATE—										
	Repairs and Improvements to St. Mary's Lodge ... ..	...	...	...	...	...	...	772	2	10	
106	Other Repairs ... ..	...	...	...	...	...	...	27	15	6	
								799	18	4	
	GARDENS—										
227	General Additions, Repairs, & Expenses ... ..	...	...	...	...	...	...	157	17	6	1171 19 0
	<i>Purchase of Property:</i>										
	No. 1, Marygate ... ..	...	...	...	...	...	...	175	0	0	
	Nos. 12 and 14, Bootham ... ..	...	...	...	...	...	...	1300	0	0	
								1475	0	0	
44	Library—Purchases ... ..	...	...	...	...	...	...				18 17 0
96	Lectures ... ..	...	...	...	...	...	...				75 0 0
19	Printing and Stationery ... ..	...	...	...	...	...	...				29 19 7
6	Printing Communications to Members and Postage of same ... ..	...	...	...	...	...	...				8 4 11
459	Printing Reports and Postage thereof ... ..	...	...	...	...	...	...				101 19 5
	<i>Gas, Coal, Coke, and Electricity:</i>										
13	Gas ... ..	...	...	...	...	...	...	17	5	3	
205	Coal, Coke and Cartage ... ..	...	...	...	...	...	...	195	3	9	
17	Electricity ... ..	...	...	...	...	...	...	24	11	2	
								237	0	2	
	Keys for Garden Gates and Repairs to Locks ... ..	...	...	...	...	...	...				24 14 0
	Donation towards Restoration of St. Mary's Church, Castlegate ... ..	...	...	...	...	...	...				10 0 0
7	Sundry Postages ... ..	...	...	...	...	...	...				10 8 6
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								341	3	7	
								£341	3	7	

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- Anderson, Reginald, 1, Queen Anne's Road.  
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 Dodsworth, L. L. S., "Kenmare," Queen Anne's Road.  
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 Gill, J. P., 50 Marygate.  
 Golledge, George Henry, 31 St. Saviourgate.  
 Holgate, H. E., Portland House, Gillygate.  
 Heslop, George A., 6 St. John's Crescent.  
 Hill, E. H., Coney Street.  
 Humphries, Walter, 23 Bootham.  
 Hurd, W. H., 25 De Grey Street.  
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 Jackson, H. G., 9 St. Mary's.  
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 Pearson, Miss M. E., 27 High Petergate.  
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 Palphramand, W., 31 Sycamore Terrace.



Parker, Albert V., Boys' Industrial School, Marygate.  
 Purnell, Mrs., Coney Street.  
 Rockett, George Lyde, 57 Huntington Road.  
 Ryan, M. L., 30 Cromer Street.  
 Rankin, Alex., 17 Newton Terrace.  
 Spence, J. J., 34 Clarence Street.  
 Swabey, Colonel M., Military Hospital, Fulford.  
 Teasdale, W. M., 97 High Petergate.  
 Tate, J. Arthur, 30 Blossom Street.  
 Warren, J., 113 Lowther Street.  
 Wray, H. A., 18 Mill Lane, Heworth.  
 Watson, A., 75 Monkgate.  
 Watson, S., 2 Low Ousegate.  
 Webb, Captain Gerald P., 13 Clifton Dale.

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 Munby, Miss, 136 The Mount.  
 Morris, Mrs., 19 Bootham Crescent.  
 Nicholls, Miss M. T., 60 Scarcroft Hill.  
 Spence, Miss, Almery Garth, Marygate.  
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## RESIGNATIONS.

Members, 23  
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Associates, 2.

## DONATIONS TO MUSEUM AND LIBRARY.

## LIBRARY.

BOOKS PRESENTED.	DONORS.
American Ethnology, Bureau of :— Bulletins 60 (Part 1), Nos. 68, 69, 70, 71; 33rd Annual Report, 1911-12.	Bureau.
American Geographical Society : Geo- graphical Review :—Dec., 1919 ; Jan., Feb., April—Dec., 1920; Index to Bulletin (1852-1915); Index (Vol. viii.), July—Dec., 1919; Index Vol. ix.	Society.
Ashmolean Museum of Art and Archæ- ology : Report of the Visitors (1919).	Librarian.
Ashmolean Natural History Society : Proceedings and Report for 1919.	Society.
Australian Museum : Reports of the Trustees for 1916, 1917, 1918.	Librarian.
Bergen Museum : Aarbok, 1917-18, 1918-19; Aarsberetning, 1918-19.	Librarian.
Bristol Naturalists' Society : Annual Report and Proceedings, Fourth Series, Vol. v., Part II.	Society.
British Museum : Catalogue of Lepidoptera Phalænæ, Supplement Vol. ii.—Text and Plates; Handbook of British Mosquitoes; Flora of Jamaica, Vol. iv.; Summary Guide to the Exhibition Galleries; Economic Series, No. 1 A—The House Fly—its Life History, etc; Economic Series, No. 2—Furniture Beetles; Economic Series, No. 9 —Birds beneficial to Agricultural; Economic Series, No. 10—Marine Boring Animals.	Trustees.

- Canada, Department of Mines, Geological Survey: Bulletin No. 29 Geological Series No. 36—Oct. 18th, 1919). } Librarian.
- Colchester Museum of Local Antiquities: Report of the Museum and Muniment Committee for the 2 years ended 31st March, 1920. } Curator.
- Croydon Natural History and Scientific Society, Proceedings and Transactions of: Vol. viii., Part 5. } Society.
- Denmark, Memoires de L'académie royale des Sciences et des Lettres de Denmark: "The Lactic Acid Bacteria" (Text and Plates).  
Det Kgl. Danske Videnskabernes Selskab, Mathematisk-fysiske Meddelelser: I. 13; I. 14; I. 15; II. 4; II. 6—11.  
Biologiske Meddelelser: I. 13; II. 1. } Academy.
- Edinburgh, Royal Society of: Proceedings, Vol. xxxix., Part 3 (pp. 209—310); Vol. xl., Part 1 (pp. 1—96); Transactions, Vol. lii., Part 3. } Society.
- Education (Scotland): Report for 1919-20. } Director.
- Firenze, Bollettino delle Pubblicazioni Italiane, 1919, Nos. 223—230, 232. } Librarian.
- Geologists' Association, Proceedings of: Vol. xxxi, Parts 1, 2, 3, 4; Index to Vols. xxi. to xxx. of Proceedings of Geologists' Association. } Association.
- Hawaiian Volcano Observatory: Bulletins, Vol. vii., Nos. 10, 11, 12 (Oct.—Déc., 1919); Vol. viii, Nos. 1—9 (Jan.—Sept., 1920). } Director.
- Illinois State Geological Survey: Bulletin, No. 37. } Librarian.

- India : Scientific Reports of the Agricultural Research Institute, Pusa, 1918-19; Reports on Progress of Agriculture for 1918-19. } Institute.
- India, Records of Geological Survey of : Vol. i., Part 4 (1919); Vol. ii., Part 1 (1920).  
Memoirs of Geological Survey of : Vol. vii, Memoir, No. 1; Vol. xlvii., Part 1. } Survey.
- Leeds, University of: 15th Report (1918-19); Calendar for 1920-21. } University.
- Manchester: Notes from the Manchester Museum, Nos. 24, 25. } Museum.
- Manchester Geographical Society, Journal of: Vol. xxxiv., Parts I—IV., 1918; Vol. xxxv., Parts I—IV., 1919. } Society.
- Meteorological Office :  
Weekly Weather Reports, Jan.—Dec., 1920; ditto, Report, 4th Quarter, 1919; ditto, Report Appendix 1 (First Quarter); ditto, Report, 1919, Appendix 2; ditto, Report, Values for whole Year; ditto, Report, 1920, Appendix 1 (Second Quarter); Monthly Weather Reports, Dec., 1919—Nov., 1920; Circular, No. 44; Summary for Year 1919; Book of Normals of Meteorological Elements (for periods ending 1915); Monthly Fly-sheet, Jan. 1920; Book of Normals; Meteorological Office Circular (June, 1916—Feb., 1920; Southport Auxiliary Observatory, Annual Report, 1919; British Meteorological and Magnetic Year Book, 1919 (Parts 1 and 2) and Part } Office.

*Meteorological Office—Continued.*

- 3 (Section I); 15th Annual Report ;  
Summary of Records of Temperature  
and Rainfall (Nov., 1920) ; Calendar  
for 1921 with notes and diary of  
operations. } Office.
- Mexico, Instituto Geologico de: Anales  
del, Nos. 8, 9. } Institute.
- Mycological Notes : Nos. 39—47 ;  
Synopsis of the genus *cladoderris* ;  
ditto, *Stipitate* stereums. } C. G. Lloyd—  
Lloyd Library.
- New York Academy of Sciences, Annals  
of: Vol. xxv., pp. 309—416 ; Vol.  
xxix., pp. 1—131. } Academy.
- New York Public Library, Bulletins of:  
Dec., 1919—Nov., 1920. } Librarian.
- Norske Meteorologiske Institut :  
Nedboriagttagelser I Norge-Aargang  
xxv., 1919 ; Jahrbuch, 1919. } Institute.
- Northants. Natural History Society and  
Field Club : Vol. xx., Nos. 157—160. } Secretary.
- Norway : An Account of the Crustacea  
of Norway (by G. O. Sars) Vol. vii.,  
Parts 3 and 4, 5 and 7. } Prof. G. O. Sars.
- Norwich : Report of Castle Museum  
Committee, 1919. } Committee.
- Nova Scotian Institute of Science :  
Proceedings and Transactions, Vol.  
xiv., Part 4. } Institute.
- Observatorio astronomico nacional de  
Tacubaya, Anuario del (for 1921). } Director.
- Persian Coins, Catalogue of : Shahs of  
Persia, Gupta Dynasty, Moghul  
Dynasty. } Librarian—  
British Museum.
- Perthshire Society of Natural Science,  
Transactions and Proceedings of :  
Vol. vii, Part 1. } Society.

- |  |                               |
|--|-------------------------------|
| Peru: Boletin del Cuerpo de Ingenieros de Minas de Peru, No. 98.   | Librarian.                    |
| Quarterly Return of marriages, births, and deaths in England and Wales, (No. 285).   | Registrar General.            |
| Rochester Academy of Science: Proceedings, Vol. v. (pp. 59--121, 123--160, 161--240, 241--288); Vol. vi., No. 1 (pp. 1--55).   | Academy.                      |
| Royal Charities: (Part 3) by Helen Farquhar.   | Miss Helen Farquhar           |
| Royal Society, Proceedings of:<br>Series A, Vol. xcvi., No. A 680.<br>Series A, Vol. xcvi., Nos. A 681--686.<br>Series A, Vol. xcvi., No. A 689--690.<br>Series B, Vol. xci., Nos. B 637--639, 641.  | Rev. Prof.<br>T. G. Bonney.   |
| Salisbury, South Wilts. and Blackmore Museum: Annual Report, 1919-20.  | Curator.                      |
| Scottish Marine Biological Association: Annual Report, 1919.   | Association.                  |
| Sheffield: Report of Public Museums and Mappin Art Gallery, from 20th March, 1914--25th March, 1919.   | Curator.                      |
| Sheffield Literary and Philosophical Society: Annual Report for 1919.  | Society.                      |
| Sheffield Banking Co., Ltd.: An Historical Sketch, 1831--1916.   | Sheffield<br>Banking Co. Ltd. |
| Smithsonian Institution:<br>Annual Report (showing the operations, expenditures, and condition of the Institution for the year ending June 30th, 1917); Report on the progress and condition of the U.S. National Museum for year ending June 30th, 1919; Annual Report, 1918. | Institution.                  |

Société royale norvégienne des Sciences  
à Thronthjem, la : Det Kgl. Norske  
Videnskabers Selskab: "Johan Ernst  
Gunnerus" ; Aarsberetning for 1915,  
1916, 1917 ; Det Kgl. Norske  
Videnskabers Selskabs Skrifter, 1915,  
1916, 1917. } Society.

Toronto, University of Toronto Studies:  
Physiological Series, Nos. 24—32 ;  
Geological Series, No. 11 ; Biological  
Series, No. 18 ; Papers from the  
Physical Laboratories, No. 62. } Librarian.

Torquay, Natural History Society,  
Journal of : Vol. ii., No. 6. } Society.

United States Geological Survey: Nos.  
I A, I B, I C ; Nos. I. 1—14, 16—19,  
21—29 ; Nos. II. 1—36 ; Bulletins,  
Nos. 597, 620, 623 (Appendix A)—  
625, 637, 639, 642, 644, 647, 648,  
650, 651, 654—658, 662, 663, 665—  
667, 670—672, 678, 680, 681, 684,  
692, 694—696, 698—701 ; Bulletins,  
Nos. 660 (A), 661 (A), 690 (A), 691  
(A), 710 (A), 715 (A), 716 (A), 660 (B),  
661 (B), 691 (B), 710 (B), 711 (B),  
715 (B), 716 (B), 660 (C), 661 (C),  
690 (C), 691 (C), 710 (C), 711 (C),  
715 (C), 716 (C), 660 (D), 661 (D),  
690 (D), 691 (D), 710 (D), 711 (D),  
715 (D), 660 (E), 661 (E), 690 (E),  
710 (E), 715 (E), 640 (F), 660 (F),  
661 (F), 690 (F), 710 (F), 711 (F),  
715 (F), 640 (G), 641 (G), 660 (G),  
661 (G), 691 (G), 711 (G), 640 (H),  
641 (H), 660 (H), 661 (H), 691 (H),  
711 (H), 641 (I), 661 (I), 691 (I),  
640 (J), 641 (J), 660 (J), 691 (J),  
640 (K), 641 (K), 640 (L), 641 (L): } Survey.



*United States Geological Survey—Continued.*

- Water Supply Papers, 425 (A), 450 (A), 490 (A); 400 (B), 425 (B), 450 (B), 400 (C), 425 (C), 450 (C), 400 (D), 425 (D), 400 (E), 425 (E); Water Supply Papers, Nos. 361, 362, 380, 381, 382, 389, 390, 391, 393, 394, 396, 401—410, 412—421, 423, 424, 426, 428—436, 438, 439—446, 448, 451, 452, 454, 455, 457, 458, 474; Professional Papers, III, 93, 94, 96, 99, 101, 105, 106, 113, 115, 116, 117, 118, 119; 108 (A), 125 (A), 128 (A), 108 (B), 120 (B), 125 (B), 128 (B), 108 (C), 125 (C), 128 (C), 120 (D), 125 (D), 128 (D), 108 (E), 120 (F), 120 (G), 108 (H), 120 (H), 108 (I), 108 (J), 108 (K), 98 (L), 98 (O), 98 (R), 98 (S), 98 (T); Preliminary Report on the Mineral Resources of the United States in 1918; ditto, 1916, Parts 1 and 2; ditto, 1919 (Preliminary Summary); ditto, 1914 (Part 1, Metals); ditto, 1914, (Part 2, Non-metals); ditto, 1915, (Part 2, Non-metals); Annual Reports, 37th, 38th, 39th, 40th.
- Upsala, Bulletin of Geological Institution of: Vol. xvi. } Institution.
- Verhandlungen der Naturforschenden Gesellschaft in Basle: No. 30. } Librarian.
- Vie Vertébrée Insulaire: Contributions a l'Étude de la (Par E. G. Dehaut). } Author.
- Vienna, Annalen des k.k. naturhistorischen Hofmuseums: Bd. xxviii—xxxiii. } Librarian.
- Wales, National Museum of: 12th Annual Report (1918-19). } Librarian.

- Whitby, Literary and Philosophical } Society.  
Society : 97th Report.
- York : Annual Report of the City of } Committee.  
York Education Committee, 1919.
- York : Annual Report of Medical } Medical Officer  
Officer of Health, 1919. } of Health.
- Yorkshire Fishery District : 53rd } Secretary.  
Annual Report.
- Yorkshire : 8 Six-inch Maps of (Un- } Mr. J. Scott.  
coloured).
- Zoological Society : Proceedings of } Society.  
1919-20 ; ditto, Part 3 (Sept., 1920) ;  
List of the Fellows, Members, etc.,  
of the Zoological Society of London,  
1920.
- "Work on Foreign Coins" (Otto } Mr. G. Benson.  
Helbing Nachf) ; "The Solar  
System," by John Senex, 1746 ;  
"Foxe's Acts and Monuments," Vol.  
ii., 1631, 1212 pp. Index.
- Manuscript Volumes of Copies of Wills } Mr. R. B. Cook's  
in the York Probate Registry. } Executors.
- A number of works relating to coins } R. B. Cook's Bequest.  
and medals, consisting of : books,  
pamphlets, and catalogues.

## ANTIQUITIES.

- Two Duke of Wellington Razors. Mr. C. E. Elmhirst.
- Giles Window. Mr. Dodgson.
- Bronze Jubilee Medal. Mrs. H. J. Elmhirst.
- Norman Stones. Miss Millington.
- Spoon Mould. Mr. W. Horne.
- Steel Engraving (Darwin). Miss Buckle.
- Collection of Stone from Mount Vale. Mrs. Crossley.

Pair of old Scales for weighing gold coin. } Mr. T. Howard.

Large Oil Painting (The Manor Shore); Oil Painting (The Castle Mills), by T. Guy; Two Oil Paintings on panels: (1) Lendal Ferry, (2) Old Ouse Bridge; Large Coloured Lithograph (York Minster); Coloured Lithograph (St. Mary's Abbey); Lithograph (John Phillips), by T. H. Maguire, 1851; Photo (Dicky Naylor); Chart (English Mediæval Architecture); 35 Engraved Copper Plates, by Cave and others, of views of York; Dicky Naylor's Walking Stick (as shown in photo); Rapier; Irons from York Castle; Objects found in Clifford's Tower excavation; Objects found in High Ousegate excavation; Peat found in Nunnery Lane 7ft. below the surface. } Mr. G. Benson.

Some fragments of Stained Glass from the ruins Kirkham Abbey, } E. H. Clough  
Taylor, Esq.

A series of Indian coins, British coins, and 4 paper impressions of seals. } Miss Todd.

A very fine Collection of stone, flint, and bronze implements, collected by the late Mr. T. Boynton, and presented by } Mr. Harland.

Astronomical Clock. } Mr. Kleiser.

The late Mr. R. B. Cook bequeathed to the Y.P.S. his Collection of Roman and English coins on condition that they be kept together and known as the Robert Cook Collection. } Mr. R. B. Cook's  
Executors.

A Sixpence of George III, 2 Groats, and a Three-halfpenny Piece. } Mr. S. H. Smith.

## CERAMICS.

Don., Hull and Leeds Pottery (col-  
lected by the late Mr. T. Boynton) } Mr. Harland.  
presented by

## GEOLOGY AND MINERALOGY.

A small Collection of Rocks and  
Fossils. } Mr. Gunning.

Model of Diplodocus Carnegii. } Rev. H. N. Hutchinson

Minerals, etc. } Col. Meysey-Thompson

## ZOOLOGY.

Little Owl in flesh, shot at Wressle. } Mr. Watson, Junr.

Arabian Lizard from Egypt. } Mr. J. E. Gibbs.

Peregrine Falcon. } Mr. Burtt.

A Richardson's Skua, Cleethorpes,  
1902, and Nightingale (shot at  
Ferriby Hall). } Mr. A. W. Linfoot.

A great Spotted Woodpecker, shot at  
Clifton, York, Jan., 1921. } Mr. J. E. Gibbs.

Rough-legged Buzzard, shot at Crow-  
land, Peterborough. } Dr. Frank  
Husband-Clutton.

Immature Great-crested Grebe, shot  
at East Cottingwith, Oct. 30th, 1920. } Mr. S. H. Smith.

Nine Skins of Humming Birds. } Miss Todd.

Sponge (recent), and Antler of Red  
Deer. } Col. Meysey-  
Thompson.





# NOTES ON THE LATER TERTIARY INVERTEBRATA.

By ALFRED BELL.

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SO far back as A.D. 1891 I was privileged to lay before the Yorkshire Philosophical Society, a general Synopsis of the Crustacea and Echinodermata of the Upper Tertiaries of these islands, notifying the species recognised, and the different horizons they occurred in. With the hope that it may be useful to future students, I now offer a revision of the above and some general remarks upon some other divisions of our Invertebrate Fauna. Want of space precludes more than a passing reference to the larger series of Entomostracan and Rhizopodal species.

I have mostly retained the old familiar nomenclature as being more easily understood by most geologists and naturalists (experts and those who prefer the more advanced synonymy can easily make such alterations as may seem desirable), the more so as there is no central index or code at present available to which students can be referred.

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Abbreviations—Plioc. (Pliocene). Cor. Cr. (Coralline Crag). R. Cr. (Red Crag). Icen. (Icenian). Pleist. (Pleistocene). Est. Cl. (Estuarine Clay). R. B. (Raised Beach). Hol. (Holocene). K. Mid. (Kitchen Middens and Shell Heaps).

\* Representatives of Species so marked are in the Museum of the Yorkshire Philosophical Society.

## MOLLUSCOIDEA (including Polyzoa, Brachiopoda, and Tunicata).

### POLYZOA.

The later tertiary polyzoa in these islands have not received much attention of late years since the publication of Dr. Busk's "Monologue on the Crag Polyzoa" in 1859, and the comprehensive lists of species in the "Proc. Geol. Assoc.," London, 1872, beyond a few

scattered notices by Dr. Hincks, Mr. Vine, myself, and Messrs. Crosskey and Robertson, "Tran. Geol. Soc.," Glasgow, whose work on fossils include a goodly number of these organisms including the beautiful \**Idmonca Atlantica*. I may also refer to the interesting series of polyzoa given in my Selsey paper, "Report York Phil. Soc." 1892.

The reduction of temperature inaugurating the pleistocene epoch, appears to have caused the disappearance of many of the pliocene types, as out of 122 known species recorded only 27 survived the change; the pleistocene species numbering 72 in all.

Amongst the many unrecorded polyzoa not the least interesting is a brackish water form still living in the Baltic, *Eschara crustalenta*, Pallas, dredged from the Thames estuary near Gravesend, encrusting Palaeolithic implements.

Of the BRACHIOPODA, or Lamp Shells, only a limited number are known to our later tertiaries, and are

*Argiope cistellula*, Wood. Cor. Cr. Sutton.

*Discina Atlantica*, King. Cor. Cr. Sutton and Gedgrave (attached to a small oyster). Very rare, only three examples known.

*Crania anomala*, Müller. Pleist. Yorkshire, but doubtful.

*Macandrevia cranium?* Müller. R.B. Portrush, Antrim. (Portlock, "Geol. of Londonderry").

\**Lingula Dumortierii*, Nyst. Cor. Cr. Sutton, Gedgrave; R. Cr. Bentley (once).

\**Terebratula grandis*, Blumenbach. This beautiful shell has many synonyms: *T. spondyloides*, Smith, *T. maximus*, Charlesworth, *T. variabilis*, Sowerby amongst them. It is not uncommon in the Coralline Crag, where examples of five inches in length have been obtained. It is very scarce in the Red Crag where only a few small and delicate valves occur, mostly odd.

\**Terebratula Harmeri*, n. sp. The lamp shell figured by Mr. S. V. Wood, "Crag. Moll. Supp. I." pl. viii. fig. 11, differs from *T. grandis* in the shape, irregularity of outline and the large and conspicuous foramen. Unlike *T. grandis*, which is rather discursive, the present shells were almost confined to a small area yielding more than 500 examples of all sizes from a quarter inch to two inches in length. A few isolated shells have been found in the later Butleyan series, but are exceedingly rare and mostly broken. Valves of all sizes invariably coarse and thick, much rolled and worn are plentiful in the older divisions of the Red Crag, and have all the appearance of

being derived from an earlier deposit. They appear to correspond with the shell figured by Mr. R. B. Newton in the "Journal of Conchology," xv., pl. 5, figs. 15—17, as *T. perforata*, Desnoyers, from the Diestian beds at Lenham in Kent. I have found the same species in the Suffolk boxstones lately.

\**Terebratulina caput serpentis*, L. Cor. Cr. Gedgrave and Sutton, and in the Pleistocene drifts of Kelsey Hill and Ayrshire. It is a rare species, and the later references require corroboration.

*Terebratella Spitzbergensis*, Davidson. Icen. Cr. Bramerton, unique, but has been dredged in a semi-fossil condition off the Shetland coast.

\**Rhynchonella (Hemithyris) psittacea*, Gmelin. R. and Icen. Cr., Pleist. Bridlington and March, Caithness, and the Antrim Clays and gravels. The York Museum example was one of three obtained close to a stone to which they had been apparently anchored in the Red Crag Section at Pettistree Hall, Shottisham Creek.

#### TUNICATA.

*Leptoclinum tenue*, Herdman, from the St. Erth Clays, Cornwall, is the only representative of this group in the British tertiaries.

### ANNULOSA.

#### OSTRACODA.

Students and those interested in these minute organisms will find ample details and figures in the papers and monographs by Prof. Rupert Jones, Messrs. Brady, Crosskey and Robertson, Warren, Chapman, and other writers. I have elsewhere quoted a few from the Selsey horizon, and Mr. F. Chapman has given a number of others from a later deposit in Sussex ("Proc. Geol. Ass., xvi. p. 259, 1906").

Mr. Praeger reports 50 species from the Irish Estuarine Clay, and Mr. F. Chapman has determined for me a few species. I obtained from a piece of clay in the Cranstal Cliff in the Isle of Man, which I quote as being the first species recorded from the island: *Cythere convexa*, *C. lutea*, *Cytheridia torosa*, and *C. punctillata*.

#### PHYLLOPODA.

*Apus (Lepidurus) glacialis*, Kroeg. Pleist. Lake beds at Dronachy in Fife, Corstophine, and Hailes nr. Edinburgh, Ballaugh, Isle of Man.

## COPEPODA.

The scanty knowledge we possess of these very perishable organisms is due to Messrs. Mahony and Bennie for the Scottish forms; Dr. J. D. Scourfield, who kindly permits me to publish a list of species obtained from the peat or "moorlog" dredged from the Doggerbank, and identified by him, and Mr. Hazeldine Warren for those from Ponder's End, Essex.

## COPEPODA. (All Pleistocene).

<i>Acroperus harpæ</i>	...	...	Dipple.	Doggerbank.	Ponder's End.
<i>Alona affinis</i>	...	...	—	×	—
„ <i>elongata</i>	...	...	×	—	—
„ <i>guttata</i>	...	...	×	×	—
„ <i>cf. quadraugularis</i>	...	...	×	×	—
„ <i>rectangula</i>	...	...	—	×	—
„ <i>costata</i>	...	...	×	×	—
<i>Alonella excisa</i>	...	...	—	×	—
„ <i>nana</i>	...	...	—	×	—
<i>Camptoceras macrourus</i>	...	...	×	—	—
„ <i>cf. rectirostris</i>	...	...	—	×	—
<i>Ceriodaphnia cf. pulchella</i>	...	...	—	×	—
<i>Chydorus ovalis</i>	...	...	—	×	—
„ <i>sphericus</i>	...	...	—	×	×
<i>Lydigia acanthoceroides</i>	...	...	—	×	—
<i>Lyncodaphnia sp.</i>	...	...	—	×	—
<i>Pleuroxus cf. trignellus</i>	...	...	—	×	—

## CLADOCERA.

*Daphnia pulex*. Lake beds of Burnhead, Ayrshire, Corstorphine, Edinburgh, and Dronachy, Fife (Bennie).  
 „ *sp.* Hitchin, Derwent and Erewash Valley, and Doggerbank, England; Garvel Park and Cowden Glen, Scotland.

## CIRRIPEDIA.

*Polliceps Hearii*, Dalmuir, Scotland ("Mus. Pract. Geol." London).  
*Scalpellum magnum*, S. V. Wood. Cor. Cr. Suffolk.  
 „ *vulgare*, L. Pleist. Selsey.  
*Coronula barbara*, Darwin. R. Cr. Walton Naze, Sutton and Bawdsey; Icen. Postwick.  
*Coronula (corsnulites) diadema*, Parkinson. R. Cr. Suffolk, no locality. It is a worn specimen (Darwin) and is perhaps of Diestian origin.



*Chelonobia Capellini*, Allesandri. "Boll. Geol. Ital." xxiii., pl. III., fig. 5 (1894). The test of this Cirriped is convexly depressed, more so than in the genotype *C. testudinarium*. R. Cr. Waldringfield. The only specimen I have seen is unfortunately lost sight of. Sequenza reports a species *C. depressa*, Seq. from the Italian tertiaries "affine alla *C. testudinaria*."

## BALANIDAE.

*Acasta undulata*, Darwin. Cor. Cr. Sutton ; R. Cr. Oakley.

*Pyrgoma anglua*, Sowerby. Cor. Cr. Ramsholt ; Pleist. Selsey.

*Verruca stromia*, Mull. Crags and Pleistocene generally. Scotland and Portrush, Co. Antrim.

*Balanus balanoides*, L. Icen. Cr. Bramerton and Thorpe ; Pleist. W. Cheshire, Lilleshall, Strethill, and Clacton (Essex). Fairly common in Scotland from Garvel Park, Clava, Dalmuir, and Paisley, to the later fauna of Windmill Croft and Largo Bay ; R.B. Portland ; Ireland, Wexford gravels, Ballyedmonduff, Wicklow, the Estuarine Clays of Antrim, and at Portrush.

*B. bisulcatus*, Nyst. Cor. Cr. Gedgrave, Boyton ; R. Cr. Walton Naze, Shottisham ; Icen. Bramerton.

*B. bisulcatus plicatus*, Darwin. Cor. Cr. Sutton : R. Cr. Walton Naze ; Icen. Bramerton, Cranstal Cliff, Isle of Man, probably elsewhere if looked for.

*B. calceolus*, Ellis. Cor. Cr. Sutton.

*B. cariosus*, Darwin. Pleist. Kyles of Bute.

*B. Chisletianus*, G. Sowerby. Grove Ferry, Kent. (See Synopsis, p. 4)

*B. communis*, Pulteney. R. Cr. Walton Naze, Chillesford, Easton Bavent, West Cheshire, Cranstal Cliff, Isle of Man, Scotland, passim ; Hol. Portrush.

*B. concavus*, Bronn. Cor. and R. Cr. Suffolk, generally distributed ; Pleist. Bridlington, Worden, Clava, Portland. The smooth variety has occurred in the Wexford gravels at Blackwater.

*B. crenatus*, Bruguiere. Ranges from the Cor. Cr. to very recent deposits up to the highest levels at Moel Tryfaen, Macclesfield, and Gloppa, and from Bridlington, Kelsey Hill, Claythorpe, Portslade, in the Liverpool Docks, and the raised beds of Cumbrae, Portrush, Point of Ayre, Isle of Man.

A critical examination of the examples listed as above may prove that many of the specimens so named belong to either *B. communis*, *B. plicatus*, *B. dolosus*, or even to *B. stellaris*.

- B. dolosus*, Darwin. R. Cr. Sutton, Oakley; Icen. Postwick, Weybourne.
- B. Hameri*, Ascan. R. Cr. of Oakley, Sutton, and Bentley; Icen. Bramerton and Weybourne; Pleist. Bridlington and Dimlington, high levels of Gloppa, Macclesfield, and Moel Tryfaen, drifts of West Cheshire, Strethill, Kelsey Hill, Laceby and Claythorpe; Cranstal and the Point of Ayre in the Isle of Man; Garvel Park, Loch Gilp and Old Mains, Renfrew, Scotland; Wexford gravels, Kill o' Grange, and Ballybrack in Ireland. (See Synopsis p. 5).
- B. inclusus*, Darwin. Cor. Cr. Sutton, Gedgrave, Boyton; R. Cr. Walton Naze.
- B. porcatus*, Da Costa. Rather common and well preserved in the R. Cr. Icen. Bramerton, Chillesford, Weybourne, Holderness Cliffs, Drifts of Gloppa, Lilleshall, Strethill, West Cheshire, Chatteris, March, and Lound, also Selsey and Aldrington in Sussex; common in Scotland at all horizons; Isle of Man rare; Wexford gravel and limestone drifts, Larch Hill, Dublin, the Estuarine Clay, Belfast, and the later Holocene of Portrush and Balbriggan.
- B. Sauntonensis*, Parfitt. ("A. and M. Nat Hist." (iv.) vol. 8, p. 210 with figure). On rocky floor of raised beach between Saunton and Baggy Point, North Devon, in considerable numbers, nearly all having the opercular valves in situ. Its proportion to *B. balanoides* which it has some resemblance to is as 27 mm. broad, 15 mm. long (figured specimen) to 15 × 8 for *balanoides*. Saunton is one of the few raised beaches where *balani* are found in situ.
- B. spongicula*, Brown. Cor. Cr. Sutton; R. Cr. Walton Naze, Little Oakley.
- B. (Chthamalus) stellatus*, Poli. Not uncommon in Plioc. and later deposits often mixed with *B. crenatus*. It differs from *B. crenatus* in having the valves stellated or edged at the base. (See Synopsis, p. 5).
- B. tintinnabulum*, L. Cor. Cr. Sutton and Ramsholt, where it occurred in clusters with the opercular valves in situ; R. Cr. Walton Naze and Butley, Bridlington; Pleist. Garvel Park, Bute, and Oban; Ireland, Wexford.
- B. unguiformis*, G. Sowerby. This Oligocene cirripede identified by Dr. H. Woodward was found by Mr. Harmer in the Red Crag at Beaumont, Essex; it is probably the species referred to *B. inclusus* as a "box stone" species by Prof. Ray. Lankester.

## AMPHIPODA.

*Gammarus fluviatilis*. Pleist. Kirkland in Fife, N.B.

## ISOPODA.

*Armadillium vulgare*, Latreille. Pegwell Bay and other Holocene deposits. (See Synopsis, p. 31).

*Limnoria terebrans*, Leach. Glenismaule, Ireland, as borings in fine stones.

*Porcellio scaber*, Latreille. Pleist. Ightham, Kent, and Whitehall, London.

## CRUSTACEA proper.

## (MACROUA).

*Homarus gammarus*, L. (*vulgaris*) M. Edwards). Cor. Cr. Ramsholt, Aldborough; Pleist. Ballybrack Bay, Ireland; K. Mid. Caithness. A fine example showing a series of the abdominal segments and the large claws is preserved in the Aldborough Museum.

*Potamobius pallipes*, Lereboullet. (*Astacus fluviatilis*) Fabr. Pleist. Clacton, Essex, and Stapenhall in the lower Trent Valley.

## ANOMURA.

*Eupagurus Bernhardus*, L. Cor. Cr. rare; R. Cr. at Walton Naze, very common: Pleist. Selsey, Dalmuir, Cumbrae, and the 100 foot beach at Oban, Scotland; K. Mid. Oransay.

*Galathea squamifera*, Leach. Pleist. Selsey. *Galathea* sp. Garvel Park.

## BRACHYURA.

*Atelecyclus heterodon*, Leach. Cor. Cr. Aldborough (carapace).

*Calappa* ? sp. The recorded localities in Synopsis, p. 3, require confirmation, and as the identification is doubtful may be passed over for the present.

*Cancer (Platycarcinus) pagurus*. Pliocene. Very common from the lowest to the more recent deposits, the most perfect examples, many being of large size, occurring in the Coralline Crag of Aldeburgh, and jointed limbs are not uncommon in the Red Crag. It is less common, though present in various English deposits. I can only find it quoted as coming from Garvel Park, Largo Bay, Oban, Ardrossan, and the K. Mid. of Oransay in Scotland, the Estuarine Clays of Antrim, and the Rosapenna shell heaps.

\**C. Deshayesii*. M. Edw. An imperfect carapace found at Aldborough. The portion preserved consists of the greater part of the carapace

minus the orbital region and the right lateral anterior margin, and exhibits a slightly curved basal ridge strongly granulated. The posterior margins are very short, slightly incurved, anterior margins arched, margin divided into separate well serrated lobes, surface briefly granulated in irregular patches. Length 45 mm., breadth 47 mm. Cor. Cr. Aldborough. The specimen, *see plate I, fig. 1*, is in the York Museum.

A smaller and more fragmentary example and some very fingers exhibiting their ornate sculpture are in the Ipswich Museum.

*Carcinus macnas*, L. Cor. to Chillesford Crags, St. Erth Clays, Worden Portland. Has been met with at Paisley and Oban in Scotland, and in the Est. Cl. and R.B. at Larne and Kilroot.

*Coeloma*, sp. Boxstones (Suffolk).

*Ebalia Bryerü*, Leach. Cor. Cr. Sutton, Aldeburgh.

\**Ebalia Pennantii*, Leach. (Carapace). R. Cr. Walton Naze.

*Gonoplax angulata*, Fabr. St. Erth ; Cor. Cr. (carapace) ; probably Iken.

*Hyas araneus*, Fabr. Pleist. Clava, Garvel Park, and R.B. Cumbrae. (See Synopsis, p. 3).

*Inachus dorynchus*, Leach. Cor. Cr. Aldborough (carapace). Capt. Alexander records in Ann. and Mag. N. Hist., 1836, obtaining *I. Lamarcki* from Bramerton as it is an Eocene Crab he was probably misled.

*Maia squinado*, Herbst. St. Erth. Cor. Cr. Orford and Aldborough ; R. Cr. Walton Naze, Oakley, and Butley.

*Maia verrucosa*, Edwards. A nearly perfect carapace now in the Ipswich Museum. A living Mediterranean species. Cor. Cr. Ramsholt. *See plate I, fig. 2*.

\**Pilumnus hirtellus*, Leach. Pleist. Selsey ; Ireland, Est. Cl. Magheramorne.

*Portunus corrugatus*, Penn. St. Erth ; R. Cr. Walton Naze, Scotland, King Edward, Ireland, Est. Cl. Magheramorne.

*P. depurator*, Leach. Cor. Cr. Iken (carapace, Sedgwick Mus.) ; R. Cr. Walton Naze ; Est. Cl. Belfast.

*P. holsatus* ? (Fabr). St. Erth.

*P. marmoreus*, Leach. St. Erth, Sedgwick Mus. Cambridge.

*P. puber*, L. Cor. Cr. Sutton, Sudborne, Gedgrave, Aldborough ; R. Cr. Walton Naze, Clava ; K. Mid. Cnoc Sligeach, Oransay.

*P. pusillus*, Leach. St. Erth, Selsey; Est. Cl. Magheramorne, Ireland.

*Stenorhynchus (macropodia) tenuirostris*, Leach. Selsey.

*Xantho floridus*, Leach. St. Erth, Cornwall.

There are a number of fragments, chiefly fingers, still waiting determination.

Of the Eocene Crustacea which abound in the earlier Red Crag the York Museum possesses a large number, the most interesting is the unique example of \**Nephrops Reedii*; Carter.

## ARACHNIDA.

*Erigone*, sp. Scotl. Loch Dronachy, Fife. Two spiders referred to *Linyphia* and ? *Nosticus* are mentioned by Cl. Reid ("Norf. and Norw. Nat. Soc." vol. iv. p. 248) as occurring in Norfolk amber.

## MYRIAPODA.

*Julis terrestris*. Ireland, Est. Cl. Magheramorne.

## INSECTA.

Wing Covers and other fragments pertaining to this group are not infrequent in such deposits, mostly of peaty origin, as are favourable for their preservation, but are usually entered in lists of fossils as "insect remains," although not very difficult especially when fresh of fairly accurate determination, including the valuable series found at Wolvercote, near Oxford, and the later lake deposits near Edinburgh, now lost sight of. The Cromerian series found by Mr. Cl. Reid are still waiting to be named, but we have a very interesting list of pre-Cromerian forms from Castle Eden, Durham, just published by Mrs. E. M. Reid ("Quar. Jour. Geol. Soc." xxxvi. p. 110). The Lusitanian peat bed at Lexden, Essex, described by the Rev. O. Fisher, supplies a short list of more or less exotic forms of Southern types. Many Holocene deposits, Roman sites, and late peats have yielded their quota to the number of those recorded, altogether about 120 species belonging to about 60 genera—most of them belong to the Coleoptera.

The Diptera are mainly represented by caddis cases, amongst which *Limnophylus fluvicornis* (Thames alluvium), and a *Setodes*, *Stenophylax nigrocornis* from (Aberdeen) have been recognized. They also have been noted from the Derwent Valley, Hull Docks,

Lewes levels, the Scottish lake beds, and at Ballaugh, in the Isle of Man.

A number of species are mentioned in the "Trans. Norf. and Norw. Nat. Soc." vols. iii. and v. as present in lumps of amber washed on shore, the specific identification including *Apis mellifica* and *Blatta orientalis* may be challenged, in any case they are doubtful as British. I may note here that about fifty years ago a number of beautiful insects, spiders, etc., were inserted in imitation amber (copal or Kauri gum) and foisted upon the market. They ultimately went to America.

#### HYMENOPTERA.

Dr. Berger ("Trans. Geol. Soc., London," 1820, vol. 5, p. 501) records a find of bees and nests in the alluvial drifts of the Isle of Man, in Kirk Balaff (? Ballaugh).

#### ANNELIDA.

Many of the boring worms have left traces of their work in hard rock, and shell from very early times, and these are very abundantly present in our later beds, but as the tubules are devoid of sculpture or organic matter it is not easy in all cases to say to which particular worm the perforation is to be ascribed, whether to *polydora ciliatus*, *P. hoplura*, or *Dodacaria concharum*, all of which are figured by Mr. Sothern in his paper. Specimens of their work, and of the galleries they excavate, can be seen in the Museum.

*Pectinaria Belgica*, Pallas. Pleist. Caithness; Est. Cl. Belfast.

\**Filigrana implexa*, Berkeley. R. Cr. Oakley, Sutton, Butley; Icen. Bramerton, Wexford Gravels, Blackwater, Ireland; Pleist. Garvel Park, N.B.

*Hydroides Norvegica*, Gunner. R. Cr. Walton Naze?; Pleist. Clyde Beds.

Bladder-like swellings are frequently found in the lining of certain Crag bivalves, especially the smaller Mactras to which group they seem mostly confined. The cists are irregularly swollen, and often open out at one end in a tubular orifice, and seem to have been made by the animal to mitigate the annoyance caused by the intrusion of a small annelid. They are most plentiful in the older Red Crag at Little Oakley, being seldom met with in other horizons. I have only met with it in a Pleistocene deposit at Largo Bay in Fife. It was not known at the British Museum till I sent some examples to Dr. Bather, F.R.S.

*Panthalis Oerstedtii*, Kinberg. Pleist.? Cranstal Cliff, Isle of Man.

*Sabellaria (Terebellaria) conchilega*, Pallas. Rd. Cr. Shottisham, Butley; Pleist. Selsey; Est. Cl. Belfast.

*Serpula alderi*, Robertson. Pleist. Garvel Park, named but not described.

*S. contortuplicate*, L. Cor. Cr. Ramsholt; R. Cr. Walton Naze; Pleist. Selsey, Wexford. A doubtful species perhaps *S. triquetra* as stated by Montagu.

\**S. flagelliformis*, Sowerby. Box Stones, Suffolk, in which there are also two or three non-recorded species.

\**S. (protula) protensa*, Payraudeau. Cor. and R. Cr. Common also in the Italian tertiaries. Is usually catalogued as *Teredo* by most writers. K. Mid Dunagoil Cave, W. Scotland.

*S. recta*, Walker. Cor. Cr. Wood. Genus doubtful.

*S. tricuspidate*, Sowerby. Cor. Cr. Sutton.

\**S. (Pomatoceras) triquetra*, Sowerby. Cor. and R. Cr. plentiful; Pleist. Selsey, Strethill and the Nar Valley, Scotland, Wexford; Est. Cl. Belfast, Portrush, etc.

\**S. (Pomatoceras) tubularia*, Montagu. Cor. Cr. Sutton; R. Cr. Oakley, Beaumont. *S. intricaria*, L., and *S. semisurrectus* in Philippi En. Moll. Sic. seem to be the same species.

\**S. (Pomatoceras) vermicularis*, L. Cor. Cr. Sutton, Ramsholt; R. Cr. Walton Naze, Oakley, etc.; Pleist. W. Cheshire and Scotland; Est. Cl. N.E. Ireland, Portrush.

*Spirorbis carinatus*, Mont. Cor. and R. Cr. Sutton; R. Cr. Oakley, Paisley, Scotland.

*S. communis*, Fleming. Garvel Park, Cumbrae, Shewalton, Scotland; Est. Cl. Ireland, common.

*S. corrugatus*, Montagu. Bute, Scotland; Est. Cl. Larne, Ireland.

*S. granulatus*, Montagu. Cor. Cr. Sutton; Caithness, Scotland; Hol. Portrush, Larne, Ireland.

*S. heterostrophus*, Montagu. Cor. Cr. Sutton; Pleist. Selsey; Dalmuir, Stevenston; Est. Cl. Larne; Hol. Portrush.

*S. lucidus*, Montagu. R. Cr. Walton Naze, Garvel Park, Maghera-morne.

*S. spirorbis*, L., (*borealis* Daudin, 1800, *nautiloides* Lam 1801). Cor. Cr. Sutton, Bridlington; Pleist. Selsey, W. Cheshire; Garvel Park, Dalmuir, Steventon, Scotland; Hol. Portrush, Larne, Ireland.

*S. sinistrorsus*, Montagu. Cor. and R. Cr. Sutton; Hol. Portrush.

*S. spirillum*, L. Scotland, passim, Garvel Park, Duntroon, Jordanhill.

*S. supra plana*, S. V. Wood. Cor. Cr. Sutton.

*S. Wattianus*, Scott. Garvel Park, Greenock, Scotland.

*Cycloggra multiplex*, S. V. Wood. Cor. Cr. Sutton.

*Ditrypa subulata*, Berkeley. Cor. and R. Cr. passim, Scotland, Garvel Park.

(This genus is now thought by some to be *Molluscan*).

#### EARTHWORMS.

Prof. Carvill Lewis figures in "Glacial Geology," 1894, a group of worm burrows he saw near Leicester Abbey in a stratum of Pleistocene age. Lumbricoid castings are common, buried at some depth in alluvial deposits.

#### HIRUDINAE (LEECHES).

*Haemopsis sanguisorba*. Lake bed, Cowden Glen, Scotland.

Mahoney, "Geol. Mag." 1869.

#### GEPHYREA.

*Phascolion strombi*, Montagu, (*Sipunculus Bernhardus*, E. Forbes). Pleist. Garvel Park, Caithness, Dalmuir, Scotland.

### RADIARIA.

#### CRINOIDEA.

*Antedon* (*Comatula*) *Brownii*, E. F., *A. Ransomii*, E. F., and *A. Woodwardi*, E. F., are represented in the Cor. Cr., and *A. Ransomii* with "cups" of others are occasionally found in the R. Cr. of Walton Naze and elsewhere.

*Tetracrinus felix*, Bather. R. Cr. Felixstow. Portions of stems assigned to *Cainocrinus*, *Balanocrinus*, and other Crinoids, chiefly of Eocene age were occasionally found by the coprolite diggers in Suffolk. Ipswich Museum possesses a fine head of a *Bourgueticrinus* (Chalk) from the R. Cr. A few ossicles occur in the Bridlington beds.

#### ASTEROIDEA.

*Asterias* (*Uraster*) *rubens*, Retz. Cor. and in the R. Cr. Walton Naze.

\**Solaster furcifer*, c.f. Dub, et. Kor. Cor. Cr. Sutton.

\**S. Reedi*, A. Bell. Box Stones, Suffolk. Reed Coll., York. Type.

See plate II, fig. 1.

*Goniaster*, sp. Ossicles only. R. Cr. Walton Naze.



## OPHIUROIDEA.

In this division there is little to add to the details given in Synopsis, p. 11, and a slight revision is all I have ventured upon.

*Ophiocnida brachiata*, Montagu. Cranstal Cliff, Isle of Man.

*Ophiocoma bellis*, Link, (*O. aculeata*, Müll). Pleist. Garvel Park, Gourock, Dalmuir, Paisley.

*O. rosula*, Link. Pleist. Caithness.

*Ophiolepis* (*Holaster*) *gracilis*, Allman. Arctic clays, Barrie, Dunbar, Montrose, St. Andrews.

*Ophiura albida*, E. Forbes. Pleist. Duntroon, Garvel Park, West Tarbert, Kilchattan.

*O. lacertosa*, Pennant, (*texturata*) Lamarck. Garvel Park.

## ECHINOIDEA.

*Amphidetus*; see *Echinocardium*.

*Agassizia equipetala*. J. W. Gregory. Cor. Cr. Aldborough.

*Brissus unicolor*. Leske. Cor. Cr. Orford, Ramsholt, Iken, Aldborough.

*Clypeaster Anglicus*, new sp. A fine example, now in the Aldborough Museum, was obtained from the Leiston road pit. The species (figured by Michelin, pl. xxxiv. fig. 1, *C. Michellotti*) seems to vary in its perforations quoted by Agassiz and Michelin respectively, and the unique British example agrees with this type in size, shape, and general details, but not being able to compare the two, I have for the present treated it as a separate species. Height 2 ins., length and breadth  $4\frac{1}{2}$  ins. See plate II, figs. 3 & 6.

The genus is new to the British fauna although very common on the Continent.

*Echinarachnius* (*Rhyncopygus*) *Woodii*, E. Forbes. Cor. Cr. Aldborough; R. Cr. Walton Naze, Sutton. There may have been as he suspected figured on pl. ii. fig. 6, *Cray Radiari*, another species, both are extinct forms.

*Echinocardium* (*Amphidetus*) *cordatus*, Pennant. Is widely distributed from the Cor. Cr. to later Pleistocene deposits, preserved with spines at Walton Naze. To the localities previously recorded (Synopsis, p. 11) may be added R. Cr. Hollesley; Pleist. Kirmington, Yorks., Kilchattan, Lock Fyne, Largo, and Shewalton in Scotland, and Limavady in Co. Antrim.

*Echinocyamus pusillus*, Müller. See Synopsis, p. 9, for details.

Common to the Crag it is a rare species elsewhere. I only know it from Selsey, Chichester, Loch Crinan, the mid-Argyle coast, and Largo Bay in Fife. The var. *Suffolciensis* occurs at Beccles. *E. oviformis* Cotteau makes out to be a distinct species.

*Echinolampas subrostratus*, Gregory. See Synopsis, p. 10.

*Spatangus purpureus*, Müller. (Synopsis, p. 11) add boring at Lowestoft.

*S. regina*, Gray. Cor. Cr. Sutton. Seems to be only a larger form of this fine Echinoderm.

\**S. Raschi*, Lovén. Prof. Gregory suggests that the specimen in the Reed Coll., York, may be this, but more perfect examples are required to establish its identity. A very prominent distinction seems to be the projection of the test at the vent.

*Schizaster*, sp. A genus new to the British Pliocenes, determined by Dr. F. Bather from a fragment obtained by the writer, (now in the British Museum). Cor. Cr. Brom Hill, Gedgrave.

*Cidaris Belgica*, Cotteau. Cor. Cr. Aldborough, Sutton.

Two small cidaria found in the R. Cr. of Walton Naze and Oakley, were probably derived from an earlier deposit. Although much worn they seem to correspond to *C. fragilis*, Airighi (Pal. Ital." vii. pl. xix. fig. 3, 4).

*C. pisum*, A. Bell. Cor. Cr. Aldborough (see Synopsis, p. 7). It may be the young of the next species, which is still living in boreal seas.

*Dorocidaris papillata*, Leske. Diestian beds, Lenham, Kent. (R. B. Newton.)

#### TEMNECHINUS.

Prof. Gregory has considered most of the Crag species to be sex variation, or indication of different stages of growth, and referred them to *T. Woodii*, Agassiz. It will be more useful at present to treat them as Forbes did in his monograph on "Tertiary Echinoderms," as I have done already in Synopsis, p. 7, to which I may refer for localities. I have added to the Forbes list of species *T. Forbesii*.

\**Temnechinus excavatus*, Wood. Cor. and R. Crs.

\**T. globosus*, E. Forbes. Cor. Cr.

\**T. melocactus*, E. Forbes. Cor. Cr.

\**T. turbinatus*, E. Forbes. Cor. and R. Crs.

\**T. Forbesii*, A. Bell. Cor. Cr.

\**T. ? megastorna*, A. Bell. (*Diadema megastoma*, Synopsis, p. 7), is not very rare in the older R. Cr. at Oakley, Foxhall, and Waldingfield, but from its appearance and matrix appears to be older. Spines of *Diadema* are recorded from the Diestian sands (R. and A. Bell), and the Cor. Cr. (S. P. Woodward).

*Temnechinus*. Prof. Gregory ("Proc. Geol. Ass." vol. xii. p. 48), refers a St. Erth species to *T. Woodii*. I do not know it from that locality, and imagine it must be the form I described in my Report on the Shell Beds of St. Erth, in the "84th Report of the Roy. Geol. Soc., Cornwall," 1898, as *Echinus Etheridgii*. It occurs as small ambulacral plates.

\**E. (Arbacia c.f. monilis)*, Agassiz. The York Museum contains an Echinoderm found in the R. Cr. of Walton Naze many years ago, which appears to belong to, or a near ally of this species. It was probably derived originally from the earlier sub-crag fauna.

\**E. (Cyphosoma)*. Cotteau and Le Hon have figured some species assigned to *C. Vincento* and *C. tertiarium*, the tests being then unknown. Since then Cotteau has figured a test which he considers to be *C. tertiarium*, and a similar form has also been found at Walton. It appears to be a true R. Cr. species. Both forms of spines occur in our older R. Cr. deposits.

\**E. (Psammechinus) Henslovii*, Ed. Forbes. R. Cr. Walton Naze and Waldringfield.

\**E. (Psammechinus) ruber*, W. Keeping. R. Cr. Walton Naze. This is the female of the preceding according to Prof. Gregory.

\**E. (Psammechinus) sphaeroideus*, Cotteau. Cor. Cr. Sutton, Boyton; R. Cr. Walton Naze.

\**Echinus esculentus* (*E. sphaera*, Müller). St. Erth. Cor. Cr. Orford, Sutton, Gedgrave; R. Cr. no references; Sudbourne Church Walks, common in Scotland, Garvel Park, Kilchattan, Bute, Loch Lomond, and the later deposits or raised beds of Largs, Largo, Cumbræ, and Shewalton, Wexford gravels, and Est. Cl. L. Larne.

*E. Etheridgii*, A. Bell. See under *Temnechinus*.

\**E. Lyellii*, Ed. Forbes. Cor. Cr. Ramsholt.

\**E. miliaris*, Müller, *E. neglectus*. Cor. Cr. Orford, Sutton; R. Cr. Foxhall; Pleist. Pentney Warren in the Nar Valley, Caithness, Loch Fyne, Scotland, Irish Est. Clays in several localities and Portrush.

*E. Norvegicus*, Sars. Pleist. Bridlington, Fort William, N.B.; and the Est. Cl. of Lough Larne.

\**E. pauciniliarss*, Gregory. R. Cr. Butley Mill (Synopsis, p. 9).

\**E. Woodii*, Desor, (*E. melo*, E. Forbes). Cor. Cr. Orford, Sutton; R. Cr. Waldringfield.

\**E. Woodwardii*, Desor (*E. Lamarchii*, E. Forbes). Diestian, Lenham; Cor. Cr. passim; R. Cr. to Aldeby and Weybourne, E. Runton; Mid-glac. Diss, Billockby and Hopton, probably derived. Spines of this or some other large species are fairly common in the R. Cr. at Walton Naze.

*Sphaerechinus brevispinosus*, Lamarck. Selsey.

\**Strongylocentrotus* (*Toxopneustes*) *Drobachiensis*, Müller. R. Cr. Butley; Icen. Cr. Bramerton; Pleist. Bridlington, W. Cheshire, common in Scotland; Raised bed, Portrush. Prof. Gregory locates this species as a Cor. Cr. form from Aldborough. His example comes nearer to *E. Cotteaui*, to which I have referred it. The Butley example was named for me by Prof. Agassiz.

*S. Cotteaui*, A. Bell. Cor. Cr. Orford, Aldborough.

\**S. lividus*, Lamarck. Icen. Sudbourn Church Walks; Pleist. Loch Crinan, Langbanks Scotland.

*S. scaber*, Gregory. Cor. Cr. Aldborough.

#### HOLOTHURIDEA.

*Cucumaria dubiosa*, Herdman. St. Erth, Cornwall.

*Psolus phantopus*. Pleist. Cl. Rothsay, Houston, Greenock, and Garvel Park, Scotland.

### COELENTERATA.

#### BALANOPHYLLIA.

This group of Corals abounds in the Red Crag but is apparently absent from the earlier Coralline strata, although fairly common in the still older Continental beds. The genus ranges in time from the Oligocene to the recent seas, and is present in the South Australian Tertiaries (Duncan). The septal arrangement varies little with us, the specific denominations depending mainly upon the mode of growth, this varying from a broad spreading base to an acute point.

Duncan separates the Balanophyllias into two sub-genera, the one comprising those with a spreading and probably an adherent base,

like *B. calyculus*, and the other those having a base more or less pedicellate. The British species or groups comprise

\**Balanophyllia calyculus*, Wood. Base spreading, corallum short and broad, nearly circular. Occurs in all stages of growth, from a mere film to communities of a dozen or more full-grown individuals united by one common exotheca. Most plentiful in the older R. Cr. but rather scarce in the Butleyan and Mid-glacial horizons. See plate I, fig. 7.

\**B. subcylindrica*, Römer. Corallum elongate, funicular narrow with contracted base or semi-pedunculated. Rather common in the older R. Cr. horizons, and of smaller growth than the preceding. The above forms are connected by a variety which I have called *intermedia*. All of these forms are in the Museum Collection. Two small examples of this genus, the largest barely a centimeter long, may be noticed here as it is doubtful if they are the same species as the above, as they taper down to a central pedunculated base. Meanwhile I have named them *B. minima*, Nova.

I have seen in Major Moore's Collection at Woodbridge a rather worn coral that appears to be new to our lists, and was probably derived from an older formation. Long, narrow, irregular, tapering to a sinuous semi-pedunculate base. Length,  $1\frac{1}{4}$  in. on inner side,  $1\frac{3}{4}$  in. outer. Calice elliptical, diam.  $\frac{1}{2}$  in.  $\times$   $\frac{3}{4}$  in. R. Cr. Waldringfield. It may be a worn example of Keferstein's species, *B. costatus*.

\**B. regia*, Gosse. Hol. Portrush.

*B. fluctuosa*, nova sp. A beautifully preserved coral in the Ipswich Museum, seems to be new to the English Crag. It is shaped like a horn of plenty, height 30 mm. Calice elliptical and slightly angular at the end of the long axis. Dimensions,  $14 \times 11$  mm. Outer skin smooth, costae fine, faintly corrugating the external wall, the whole terminating in a strongly curved and acute peduncle. R. Cr. Foxhall. Length 30 mm. See plate II, fig. 4.

*B. ? Watsoni*, nova sp. This very distinct coral has been referred by Dr. Lang (Brit. Mus.) to this genus, but it differs very materially from the generic type (fig. 5) both in outline and calicular details. Corallum tall, conical, finely pedunculate, growth rings distinct, as are the costae, the partly coalesced septae forming a thickened wall at the irregular opening, primary septa stout, the rest thin curving

inwards to a deep straight forcula, columella small, calice oval,  $15 \times 12$  mm., length 20 mm.

This specimen was obtained by myself in the R. Cr. at Waldingfield and has been in the Reed Collection for some time past. I have named it after the mutual friend of Dr. Reed and myself. *See plate II, fig. 2.*

*Caryophyllia Bredai*, Edw. et. Haime. R. Cr. Woodbridge. Probably derived from the Upper Chalk, Norfolk. ("Quart. Jour. Geol. Soc." xxix. p. 503).

*C. clavus borealis*, Fleming. Lancashire drift. ("Geologist," 1843, p. 124).

*C. clavus Smithii*, Stokes. Hol. Portrush, Co. Antrim.

\**Cryptangia Woodii*, Edw. et. Haime. Cor. Cr. Orford and Ramsholt, where it occurs in large colonies living in a Polyzoan (allied to *Cellepora palmata Michelin*). (Dr. F. Canu in litt.) R. Cr. Oakley, Walton Naze, Waldringfield, Sutton.

\**Flabellum cuneatum*, Goldfuss. May be distinguished from *F. Woodii* by its smaller size, greater solidity and prominence of the primary septae. It is not known in the Cor. Cr. R. Cr. Oakley, Waldringfield, Sutton. *See plate I, fig. 6.*

\**F. Woodii*. Edw. et. Haime. Cor. Cr. not very rare, but widely distributed, Gedgrave, Ramsholt, Iken, Boyton. *See plate I, figs. 4 and 5.*

\**F. minuta*, n. sp. This little coral appears to be new to Science, certainly to Britain. Corallite small, solid, short, broad, and truncate; base open disclosing septal arrangement; walls rather thick, fissured; costae indistinct or irregular sinuous; calice horizontal, elliptical ends rounded; septae arranged ovaly in 24 groups or systems, the inner ends joined by trabecular growths; intermediate septae absent, or not developed. Breadth 13, depth 5 mm.

As the general form of the Coral separate it from the pedunculated Crag Flabellum and I cannot find that it has been noticed elsewhere, I have named it *F. minuta*. I have only seen two or three examples. *See plate II, fig. 5.*

*Lophohelia (Oculina) prolifera*, Edw. et. Haime. Pleist. King Edward, N.B.

*Paracyathus Taxilianus* is included in the lists of Pleist. fossils in the "Glasgow Handbook, Brit. Assoc." p. 533, as coming from Largs, in Ayrshire. It does not seem to be known, and is probably an error.

\**Paracyathus*, sp. These little corals were not uncommon in one particular zone or vein in the Newbournian Zone, R. Cr. at Waldringfield, and were derived from the pre-crag beds overlying the London Clay. The corals are easily recognisable, being simple, short, subturbinate; costae seen beneath a smooth epitheca; walls thicken at margin where the larger septae are well exhibited, the smaller less so; calice, round, shallow; columella prominent, papillate. Height 15 mm.; diam. of calice 7 mm. As I can find no Continental reference to it, I propose calling it *Paracyathus suffolcianus*.

\**Solenastrea Prestwichi*, Duncan. R. Cr. Oakley, Waldringfield. The type is in the York Museum. See plate I, fig. 8.

\**Sphenotrochus Boytonensis*, Tomes. Cor. and R. Cr. With the next but not so widely diffused. ("Geol. Mag." 1888, p. 28).

\**S. intermedius*, Münster. Cor. and R. Cr. in abundance. Mid-glac. *S. Macandrewanus*, Edw. et. Haime. Pleist. Largo Bay, Fife.

\**S. parva*, A. Bell. Icen. Cr. Aldehy. This minute coral was first noticed in the "Geol. Mag." for 1888, p. 21, and still remains undescribed, no further example having been met with, and the pit it came from being closed in. It differs from *S. intermedius* in many points, and the calice is more orbicular. Reed Coll.

\**S. Selseyensis*, A. Bell. Pleist. Selsey. Figured in "Report of the Yorks. Phil. Soc." 1892, pl. i. fig. 31. Type.

*S. Wrightii*, Gosse. Pleist. Old Mains, Renfrew, N.B.

*Trochocyathus anglicus*, Duncan. R. Cr. Great Bealings and Waldringfield, Suffolk.

\**Trochosmilia* c.f. *cornucopia*, Duncan. R. Cr. Sutton. A worn coralite which appears to correspond with the figure of this species in "Duncan's Supplement to the British Fossil Corals." Pal. Soc. pl. iii. fig. 7. See plate I, fig. 3.

## HYDROIDA.

*Corallina officinalis*, L. Pleist. Selsey, and at Garvel Park, Arklieston, Paisley, and Shewalton.

*Eudendrium ramosum*. Pleist. Arklieston, Scotland; Hol. Liverpool Docks.

*Gorgonia*, sp. Cor. Cr. Sutton; Pleist. Berry Head, Devon.

*Graphularia Wetherelli*, Edw. et. Haime. R. Cr. in nodules of earlier period.

\**Hydractinia circumvestiens*, S. V. Wood. Cor. Cr. Ramsholt, Sutton, Boyton ; R. Cr. Little Oakley, Waldringfield, Sutton.

\**H. pliocena*, Allman. Cor. Cr. Orford, Ramsholt, Boyton ; R. Cr. Walton Naze, Oakley, Waldringfield.

*Jania rubens*, Lamx. Paisley, Scotland.

*Lithothamnion (Phymatolithon) fasciculatus*, Ag. Est. Cl. Maghera-morne, Ireland ; Hol. Dublin Bay.

*Phymatolithon polymorphina*, Areaoch. Dublin Bay.

*Sertularia filicula*, Huds. Pleist. Garvel Park, Scotland.

*S. polyzonias*, L. Stevenston, Scotland. ("Morris Cat.")

*S. pumila*, L. Pleist. Selsey ; Garvel Park, Scotland

*Tubularia larynx*, Pellis and Solander. Garvel Park.

*Theonimuricata*. Some spicules from the Est. Cl. Lough Larne, seem to be of this species, but require verification.

*Stysanus caputmedusae*. Appear as markings or perforations on shells. In glacial clay, Lewis in the Hebrides. (R. Etheredge).

## PORIFERA.

*Alcyonarium* allied to *Jumella*. Cor. Cr. (Brit. Mus.)

*A. gelatinosum*. St. Erth, Cornwall (Lomas in "Liverpool Geol. Assoc." 1886, p. 24).

*Cliona*. Several species of this destructive sponge are known, but the absence of spicules or any organic matter in the borings render identification uncertain. The following seem to be indicated when compared with the recent forms and may be accepted provisionally. The members of the genus seem to attack dead matter on old shells.

*C. coelata*, Grant. Present everywhere from the Cor. Cr. upwards.

*C. gorgonoides*, Hancock. A var. of the above is recorded from Shewalton in Ayrshire. It appears to be common in the harder shells of the R. Cr., attacking the hinges of *Cyprina*, *islandice*, *Pedunculus*, and *Neptunea*, the shells being eroded or eaten away on the surface.

\**C. lobata*, Hancock, is another doubtful form, but is perhaps the cause of the damage to the heavy and massive forms of *Purpura* common in the Wexford gravels which in many cases are nearly eaten away.

*Geodia*, sp. Pleist. Caithness.



*Grantia compressa*, Johnston. R. Cr. Walton Naze. (See "Wood Ann. and Mag. N. H." (1) xiii. p. 21, 1844).

*Halichondria panicea*, Pall. Stevenston, Ayrshire.

*Leucandra communis*, Haeckel. St. Erth.

*L. Johnstoni*, Carter. St. Erth.

*Spongilla (Ephydatia) fluviatilis*, Johnston. Cowden Glen, Cantyre, Scotland.

*S. lacustris*. Cantyre, Scotland.

*S. sp.* (Winter Eggs), Hornsea.

Spicules from the Severn alluvium, see Sollas, "Quart. Jour. Geol. Soc." vol. xxxix. p. 613, are referred to

*Amorphina panicea*.

*Microciona armata*.

*Dictyocylindrus*.

*Sycandra ciliata*.

*Eccionema ponderosa*.

*compressa*.

*Halichondria inornatus*.

*Suberites ficus*.

*Hymedermia inflata*.

*Tethea lyncurina*.

*Thyonidea*, sp. Liverpool Docks.

## RHIZOPODA.

The Foraminifera as a group are too large to be dealt with here, upwards of 500 species being recorded as fossil, and students may be referred to the following authorities for St. Erth, Cornwall: F. W. Millet, "Rep. Geol. Soc." Cornwall, 1885—1894. Crag Series: Jones, Burrows, and Holland, "Palæont. Soc." Selsey: Millet in Bell, "Rep. York. Phil. Soc." 1892, and Messrs. Heron-Allen and Earland, "Jour. Roy. Mic. Soc." 1909. Sussex; Chapman "Geol. Assoc." xvi. p. 259, 1900. Ireland and Isle of Man, Wright, "Liverpool Geol. Soc." Elsewhere and Scotland: Crosskey and Robertson, and Wright.

Mr. Wright, "Rep. Brit. Assoc." Belfast, 1892, reports finding 65 species in England and Wales, 40 in Scotland, 72 in the Isle of Man, and 113 in the Irish Estuarine Clays. Both Messrs. Millet and Heron-Allen have suggested that the Selsey list is partly derivative. All those quoted by me in the "Rep. Yorks. Phil. Soc." 1892, were taken from one locality opposite the then existing Thorney Coast-guard Station, the "mud-deposit" of the earlier writers.

Finally, I desire to offer to Mr. Watson of the Museum, my grateful thanks for all trouble he has taken with the MS. and in photographing many of the specimens, most of which are in the Museum of the Philosophical Society.

PRESENTED

5 JUL 1921

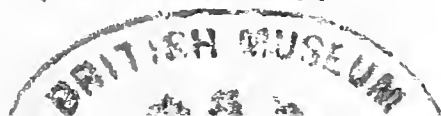
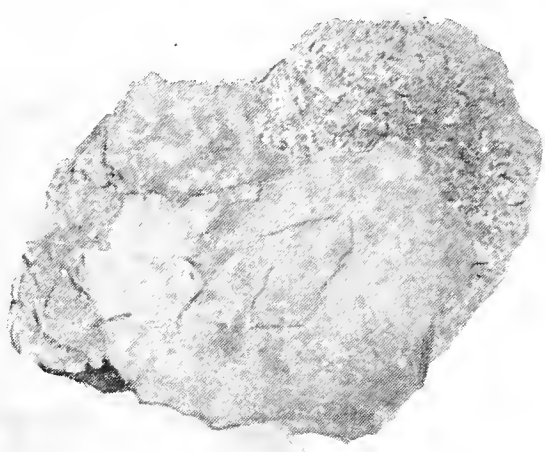






PLATE. I.



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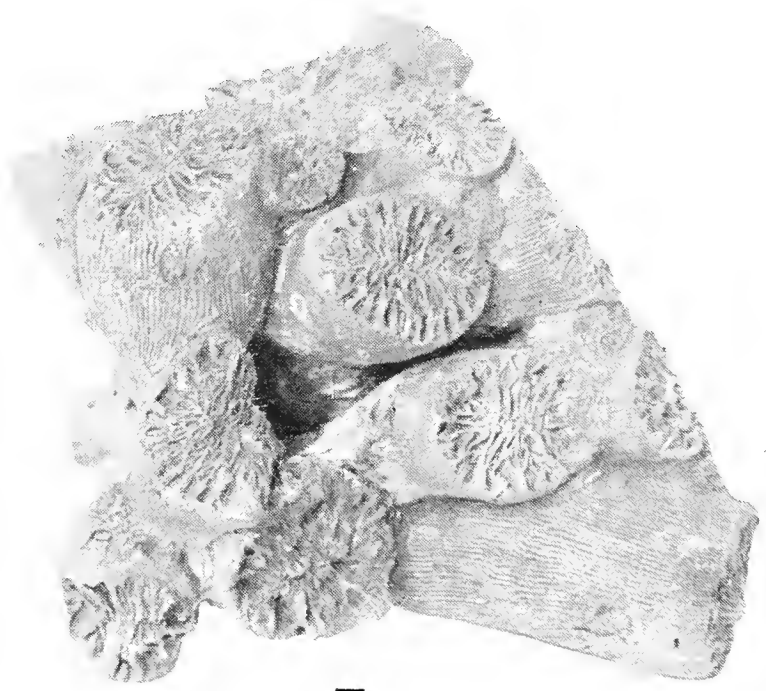
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7



8

# PLATE I.

FIG.						PAGE
1	Cancer Deshayesii	...	$\frac{2}{3}$	...	...	7
2	Maia verrucosa	...	$\frac{2}{3}$	...	...	8
3	Trochosmilia cornucopia	$\frac{2}{3}$	...	...	...	19
4	Flabellum Woodii	...	$\frac{1}{1}$	...	...	18
5	Do. showing calice	$\frac{1}{1}$	...	...	...	18
6	Flabellum cuneatum	$\frac{1}{1}$	...	...	...	18
7	Balanophyllia calyculus	$\frac{2}{3}$	...	...	...	17
8	Solenastrea Prestwichi	$\frac{1}{1}$	...	...	...	19

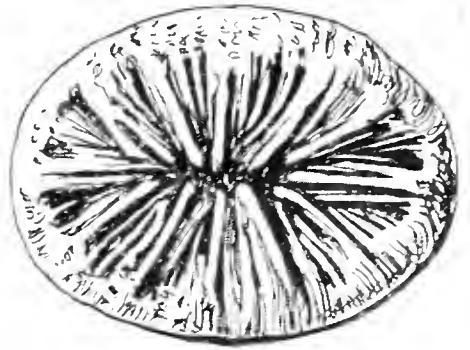


PLATE II.

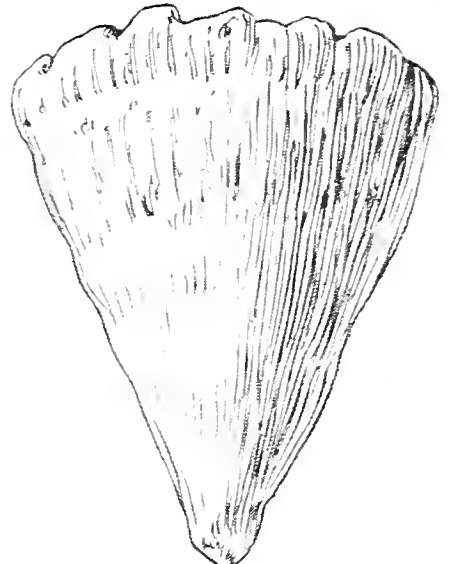
FIG.							PAGE
1	Solaster Reedi	...	$\frac{2}{3}$	...	...	...	12
2	Balanophyllia Watsoni		$\frac{2}{1}$	...	...	...	17
3	Clypeaster Anglicus		$\frac{1}{2}$	...	...	...	13
4	Balanophyllia fluctuosa		$\frac{1}{1}$	...	...	...	17
5	Flabellum minuta	...	$\frac{4}{1}$	...	...	...	18
6	Clypeaster Anglicus (under side)	...	$\frac{1}{2}$	...	...	...	13



1



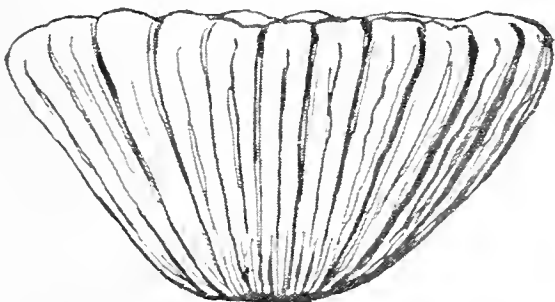
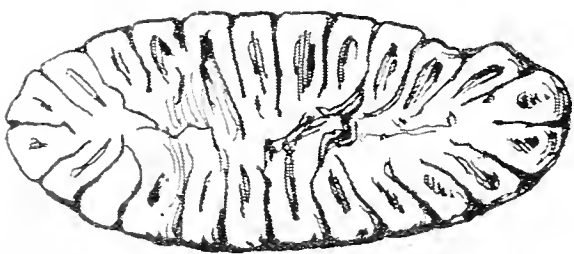
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